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INSPECTING with a MOVIE CAMERA

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A camera has recently been developed in Germany for examining long bores

INSPECTION of the interior of hollow shafts, boiler tubes, pipes, cylinders, bushings, and gun barrels has always been a difficult problem owing to the relatively small diameter of the opening. About the only possible solution has been the use of the periscope which must be laboriously moved back and forth over every square inch of surface because of its inherently limited field of vision. This procedure naturally is tiring to the eyes of the observer and is bound to influence disadvantageously the impression he receives. Furthermore, the short and single visual impression cannot be completely reconstructed from memory, and cannot be used, therefore, as a valid proof, should any contention later arise.

Recently, attempts have been made to replace visual observation by photographic means. Except where inspection is limited to only a small section of the object, in which case a local exposure would be sufficient and more economical, about the only solution is the use of the motion-picture camera. If the whole inner surface of a long pipe has to be reproduced, especially if the examination has to be repeated on a quantity of objects, the motion-picture camera is particularly adaptable, and the mechanized process proves worth while economically.

The problem is to keep down the consumption of film. For example, supposing a motion picture is wanted of a pipe 75 mm. in diameter and 3 meters long, showing the nature of the inside surface in two-diameter magnification on the film. In order to guarantee a clear visibility of all details and to avoid jerking movements when projected, the periscope end of the camera should be pulled through the pipe slowly, the advancement of the pictures during exposure not exceeding 0.1 mm. from one picture to the other. Since the total inner surface of the pipe is 7.5x300, or 7,000 sq.cm., and one film picture has an area of 4.32 sq.cm., in all 650,000 film pictures, or 12,500 meters of film would have to be used. Still more film would be used if overlapping on the sides of the strip-shaped pictures were desired, as is almost necessary with the periscope method.

Considering this volume of film and the time required for projecting, it is clear that such a method of examination is out of the question. Another method would be to take separate pictures which would be set together in sequence like the fields on a chess board. While the result would be a considerably smaller consumption of film, that is, only 1/100 the quantity used in the previous example, a disadvantage is that the pictures would have to be projected and examined separately. This procedure would necessitate the inspection of 6,500 pictures, a task so tedious that one would not care to start it.

An entirely different method in which the image is placed on a continuous strip of motion picture film, was recently developed in Germany and is being successfully used there. The diagrammatic sketch, Fig. 1, will help explain the principle of operation of the camera.

Let us assume an object of the size and position of

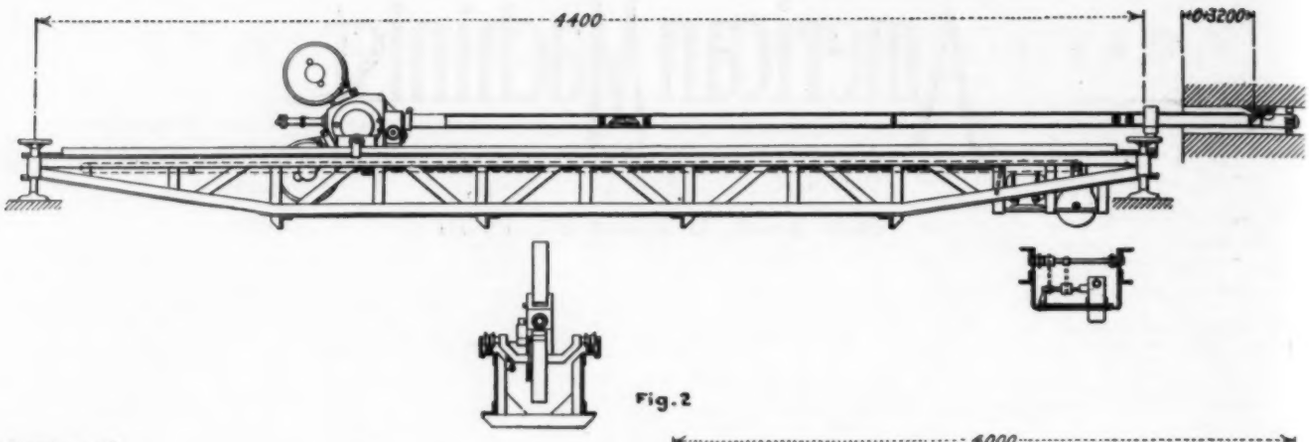


Fig. 2

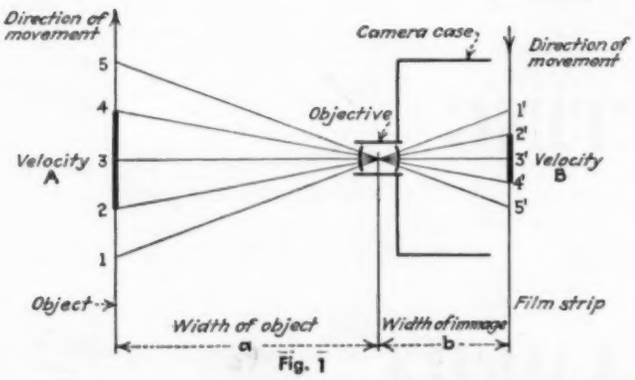


Fig. 1

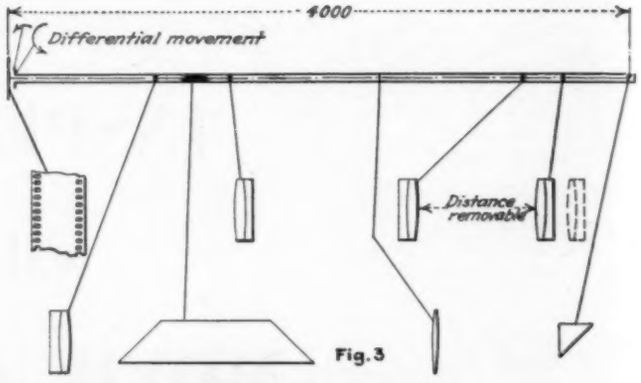


Fig. 3

Fig. 1 — Diagrammatic arrangement of an optical system for recording objects in motion. Fig. 2—Special motion-picture camera developed in Germany for examining the inside of long bores in pipes, guns, and similar objects. Fig. 3—Diagrammatic sketch of the optical system employed in the observation tube of the pipe camera

the line 2–4 in the diagram; this object will be projected through the objective lens on the film of the camera as the picture 2′–4′. If the object moves in the direction of the arrow from 1 to 5, the picture on the film will move from 1′ to 5′; that is, in the opposite direction. According to geometry, line 2–4 is in proportion to the object distance *a*, as line 2′–4′ is to the picture distance *b*. Line 2–4 and 2′–4′ being identical with the movement of the object and the picture, respectively, and as these movements take place in the same time, the velocities *A* and *B*, or distances traveled per unit time, are proportionate. Hence, the simple equation exists:

$$\frac{A}{a} = \frac{B}{b}$$

In other words, if we want to photograph a moving object on the film and obtain a clear picture, the film has to be moved in the opposite direction at a proportionate speed so that this equation is fulfilled. It can easily be seen, furthermore, that it is immaterial whether the object moves in relation to the camera, or the object stays in its position and the camera moves. In the actual application of this principle the camera has to be guided along the inside walls of the part being examined and the film has to be moved in the camera in the opposite direction at a speed selected in conformance with this equation. Because of space limitations, the camera must be mounted outside of the tube in such a way as to be movable in the direction of the pipe-axis, and must carry in front of it a periscope and an observation pipe.

In Fig. 2 is shown a drawing of the pipe camera. At the left may be seen the camera case which contains the picture window and a film drum together with feeding and receiving reels, the latter with a transmission belt. There is a dial gage on the side of the camera for measuring the consumption of film in meters. The camera is supported on a carriage with rollers on both sides running on rails supported by girder construction, as indicated. With this particular camera, which was built to measure pipes 3 meters long, the girders are 4 meters in length.

In front of the camera is a long observation pipe serving as a tongue for the camera carriage. It can be turned to cover the entire inside circumference of the pipe being examined. To the rear of the camera is an eyepiece by means of which the focus can be checked. The optical system consists of a number of lenses and prisms through which the image of the wall is reflected. For illumination, a 16-volt lamp is placed in the end of the tube in such a position as to throw its light upon the particular section being photographed. Four rollers, which can be adjusted radially to the size of the bore, are provided at the head to support rollers carried at the end of the structural support. Like the roller supports of the bore, these rollers are mounted with spring action and can be adjusted to assure the tube being concentric with the bore.

In Fig. 3 is shown diagrammatically the optics of the observation pipe. Adjustment of the front objective lens is accomplished by a rack and pinion fastened to the outer side of the observation pipe under a U-shaped cover. Opposite this is a tube holding the cable connection for the electric light bulb at the forward end.

As the inside walls of the pipe can be photographed only in strips, the observation pipe has to be turned after each trip to a certain angle, depending on the diameter

of the object examined. Turning is accomplished by a gear train and a chain, as can be seen in the detail photograph of the camera, Fig. 4. Stops can be set on the chain to determine the angle to be turned. If the observation prism at the forward end of the tube is slanted to the side, it is obvious that the picture on the film would be turned around and slanted the same way: since the film continues to run straight down, blurring would occur unless some means were taken to correct, or realign, the view. For this purpose, a second prism is provided by means of which the picture is set upright in the window, so that the direction in which the image moves is identical to that of the film.

Movement of the camera backward and forward is effected by a motor mounted at the forward end of the girder structure. Adjustable stops, mounted on the girder, reverse the camera carriage at each end of its travel, exposures being taken only on the forward trip.

It has already been indicated that the success of this method depends entirely upon accurate timing of the film speed with the speed of travel of the camera. In other words, the distance covered by the camera has to be proportional to the unrolled strip of film. In order to assure this, a steel band, perforated in the same manner as the film itself, is used as a driving member for the receiving reel. As indicated in Fig. 4, a feed roll, supported on a vertical axis extending beneath the camera, engages a perforated steel band stretched between the ends of the girder and fixed in position. The roll transmits its rotation in proper proportion to the film reel in the camera case, but only while the camera is taking exposures on its forward trip. An intermediate free-wheel coupling interrupts the movement of the film on the return trip of the camera. If, as in the case problem mentioned earlier in the article, twofold magnification is desired, twice as much film is unrolling from the reel in the camera as on the steel band. In this instance the width of the strip of inside wall exposed on the film is only 12 mm., or half the width of the picture window. Hence, turning of the observation pipe on its axis has to be adjusted so that the shifting is only 10 mm., in order to have an overlapping of the picture strips on both sides. With a 75-mm. bore, 24 picture-taking trips of the camera would be necessary to get a full photograph of the inside wall and each trip would require 6 meters of film.

To assure correct time of exposure necessary for the film, two or three minutes are required for the camera to travel 1 meter. By special electrical switches the backward run of the camera is made at a higher speed than the forward trip. In the particular example cited, a total of 3.6 hours is required to photograph the inside

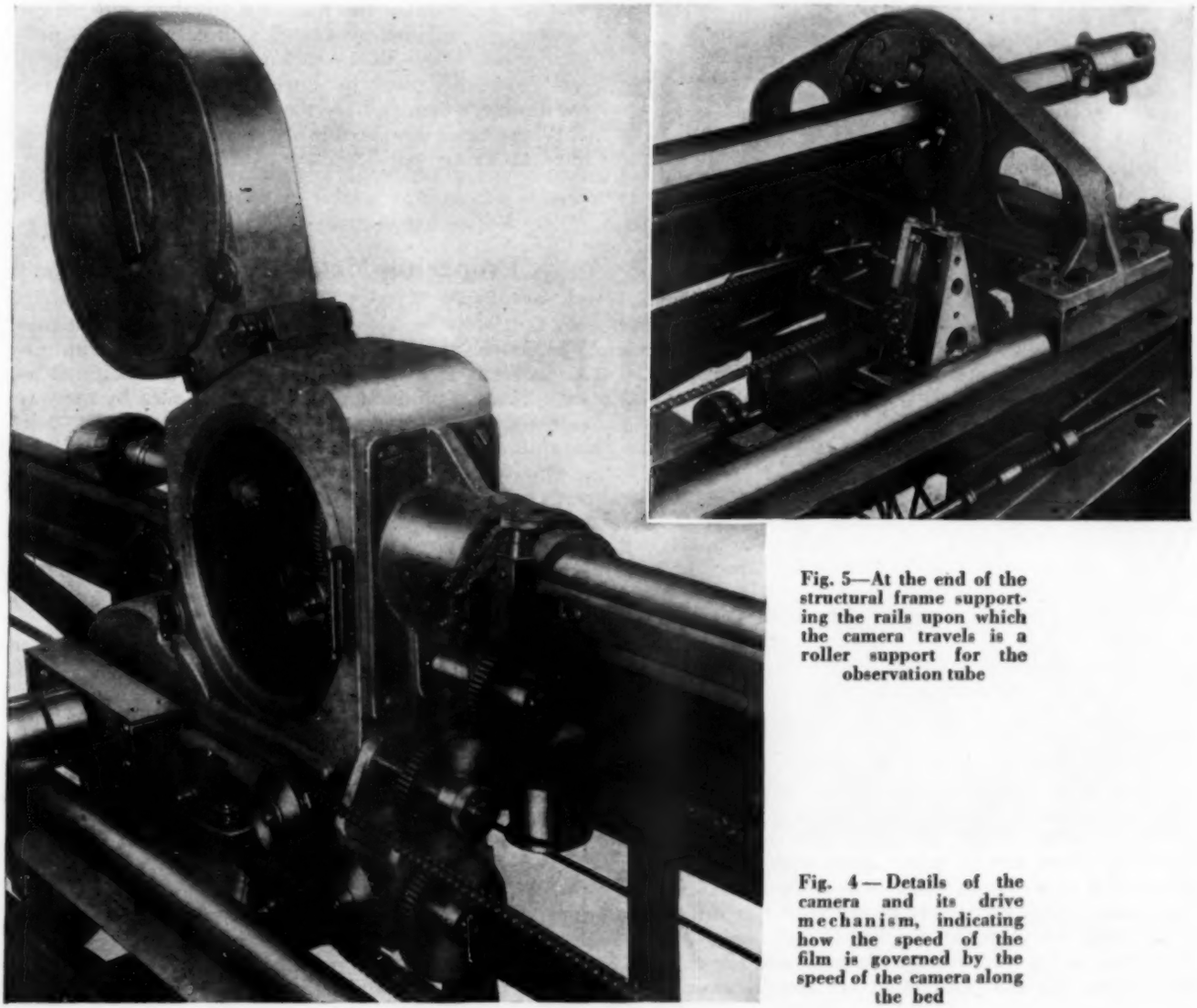


Fig. 5—At the end of the structural frame supporting the rails upon which the camera travels is a roller support for the observation tube

Fig. 4—Details of the camera and its drive mechanism, indicating how the speed of the film is governed by the speed of the camera along the bed

of the pipe. The time for one exposure on the film can be regulated by adjusting a slit in the picture window. This adjustment is necessary if the intensity of the illumination is varied, and is accomplished in a manner similar to the adjustable shutter on an ordinary motion-picture camera.

Once the camera has been set up and adjusted, all exposures and operations are made automatically, and when the entire inside diameter of the pipe has been covered, the machine stops itself. In case of trouble in the light circuit, such as would be caused by a burned-out lamp, there is a relay which will bring the machine to a stop to avoid wasted film. The lamp burns only on the inward trip.

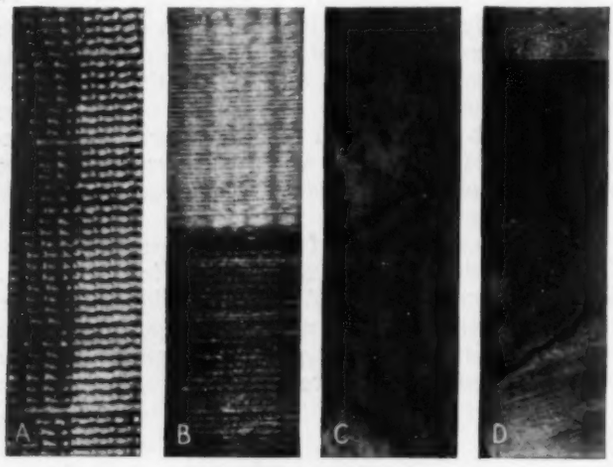


Fig. 6—Typical test exposures made by the motion-picture pipe camera: *A*—Seam-welded steel pipe, *B*—Tube partly rebored, *C*—Rust spots in a seamless gas pipe, *D*—Cracks in a cast-iron pipe sleeve

As had been indicated, the picture comes out in long, narrow, continuous strips which can be readily examined when printed on positive film or paper. In Fig. 6, several typical examples of such photographic examination are given.

■

Blind Dowel Pins and Dowel Holes

D. A. Baker

WHILE a dowel pin is one of the smallest items that go into the construction of a tool, its proper function is of the utmost importance, and yet in theory and practice it is very much neglected by both designer and mechanic.

When used for the simple purpose of holding two pieces in alignment, there is seldom any need for making the length of a dowel greater than three times its diameter, and in this case the best practice is to make the dowel a drive fit in one of the parts and a slip fit in the other. It should be driven two-thirds of the way into the one part, thus leaving projecting a length equal to one diameter. Parts assembled with blind dowels as described above can be taken apart without the use of hammering or wedging, which is as it should be. On the other hand, if more is left projecting, it is difficult to disassemble the parts, as the dowels will bind. Making the dowels a slip fit in one of the parts and leaving them project too far are points that are usually overlooked. They are a source of irritation every time it is necessary to disassemble them.

To fit blind dowels properly, it is necessary to have reamers that one can depend upon. Going to the ordinary tool crib and selecting a reamer, even though we check its size with a "mike," is no assurance of the size hole it will produce, and, therefore, to be sure, one should ream a hole in a piece of scrap of the same material as the finished work in order to check the size hole the reamer will make, rather than take a chance of spoiling a piece of work.

It has been the writer's practice to carry a private set of reamers of the usual run of sizes such as $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$, and $\frac{1}{2}$ inch. These are arranged three to a set, one a standard size reamer, one from 0.001 to 0.002 undersize, and one 0.001 oversize. In using a set, the undersize reamer is always put through the work first. Where two pieces have been clamped together and the reamer put through both pieces at one time, after the undersize reamer has been put through, the parts are unclamped and then the part which is to have the dowels a slip fit is reamed either with the standard size reamer or the oversize reamer. Selection of the one to be used will depend upon the type of fit desired and on whether the parts are to be hardened or lapped out after hardening.

Personally I should recommend that every shop should, wherever possible (I am speaking now of die and tool shops) furnish the individual worker with sets of reamers as specified above. The time wasted on making frequent trips to the tool crib, and the lessening of spoiled work caused by unreliable reamers, will very shortly more than pay for the cost of the extra reamers.

Where taper dowels only are used the precautions outlined above are not necessary.

■

Preparing Metals for Machining

Charles F. Henry

PRODUCTION is frequently affected as much by materials as by the tools with which the materials are cut. Many a production estimate has fallen by the wayside because the castings or forgings were badly scaled or chilled and could not be cut normally.

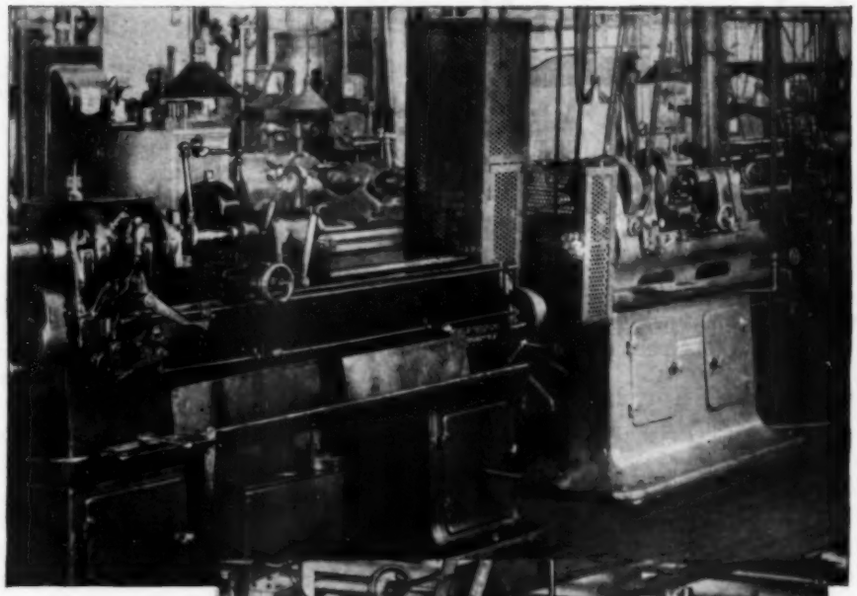
One way to attack this problem is to use some of the new super-hard tools that will cut through scale. The other is to remove the scale before the work goes to the machines. Which way is the more economical depends on conditions. While some of the super-hard tools will cut through scale, the first cost and the fear of breakage will deter many from using them.

Pickling, sand blasting, and tumbling have all been tried for removing scale, with varying succsss. The kind of metal and the process used affect results greatly. Tumbling in some cases drives the hard oxides into the softer metal beneath. These oxides frequently deform the surface of the forging when heavy pieces are tumbled and part of the scale remains in the metal to dull the tools unless the cut can get below it.

Although we sometimes do not think of the chemist in connection with pickling, it is of course a chemical process. Chemistry, metallurgy, and electricity enter into the newer methods for removing scale, and we are learning that preparing metals for machining may be almost as important to production as the tools and methods used in shaping the parts.

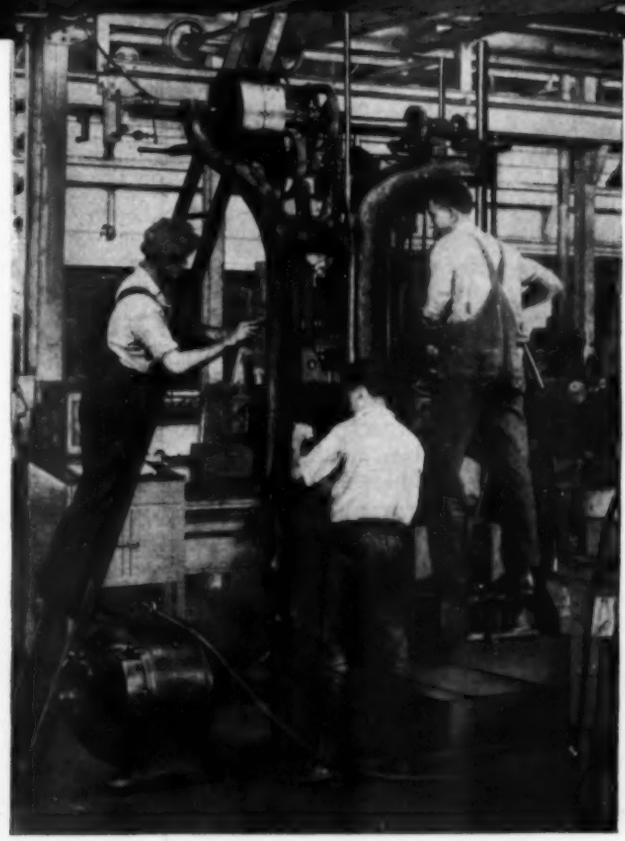
Rehabilitating Equipment in Slack Times

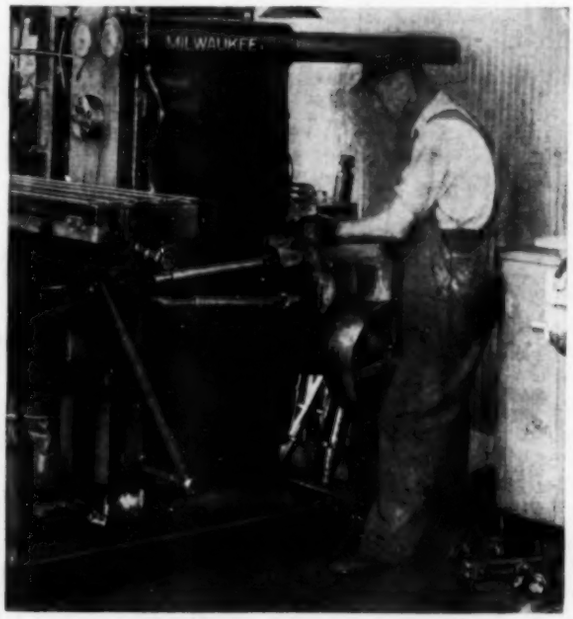
WHEN business is dull and production is off, progressive concerns take time out to put their plants in order. The accompanying photos were taken in the plant of the Kearney & Trecker Corporation, Milwaukee, where an extensive program of equipment overhaul and repainting has been carried on. Every machine tool in the shop has been scraped, filled, shellacked, and lacquered the standard machine tool gray. Cast-in makers' names were brought out by aluminum paint. Old machines have been completely overhauled and put into running order. Hand lacquering was used for machines that had to remain on the floor, but overhauled machines were finished in the spray booth before being put back into service. About forty men were employed almost steadily on this work, many of them apprentices.



Motor equipment also was overhauled, the wiring checked, controls examined, frames repainted, and voltages stenciled on them. In some instances, belt-driven machinery was motorized.

As a result of this program, not only is a pleasing appearance obtained, but general shop cleanliness has been improved, and the morale raised all along the line. With production returning to normal, the shop is all set to go.





Photographs by courtesy of Kearney & Trecker Corporation

EXECUTIVE FORUM

Salesmen in the Shop

"WHAT'S the matter, Fred — you look as though you'd lost another order," said Al Kendall, works manager of the Plane Engine Company. Indeed Fred Evans' usually cheerful sales manner did seem beclouded by gloom.

"It's a hard job to corral enough orders to keep the shop busy without having to endure your wisecracks and obstructive policies," said Evans.

"It sounds serious," said Kendall, "but I still don't see the cause of the mournful expression."

"You should," said Evans. "This morning one of my salesmen tried to go into the shop and was told he couldn't without a pass from Mr. Kendall. That doesn't help a bit."

"But why did he want to enter the shop?" asked Kendall.

"To see what progress was being made on the Central Valley Railroad order," said Evans. "He sold the job and is anxious to know whether the delivery date will be met."

"You've already given one reason for the new rule," said Kendall. "We've a planning department to follow the work and report progress when requested. When your man found the castings, he'd probably hand the foreman a couple of cigars and ask him to put them on the planer next. Then another salesman would come along following another pet job. Before long shop routine would be disrupted and everything delayed."

"I don't believe my men deliberately interfere with production," said Evans, "but I'm glad they show an interest in their orders. A poor salesman often forgets the customer as soon as he has his name on the dotted line. These men are trying to give some service. It's much more convincing to tell a man his order is in the machine shop or on the erecting floor than to simply transmit the planning department's routine report. I can't see why you want to bar salesmen from the shop."

"I'm not barring them," said Kendall. "I don't intend to be niggardly in issuing passes, but I think a man will have a reason before asking for one. This system will keep salesmen from wandering aimlessly through the shop and taking up my men's time."

"No doubt you'll keep most of them out," said Evans. "But what of the theory of yours that our salesmen should be more familiar with production methods. Having to get a special dispensation to see work in process will not encourage them in that direction."

"That training should come before salesmen are sent on the road," said Kendall, "and they can keep up-to-date at the annual sales meeting when they go through the plant from stem to stern. I should think you'd thank me for limiting these daily shop visits. I've noticed that when business is slow, salesmen spend more time in the plant than usual. This is just the time they should be out hustling for business."

"The salesmen's activity is my responsibility," said Evans. "I might point out that if your foremen followed instructions, they wouldn't take orders from the salesmen and shop confusion would be avoided. But instead you place the blame on the sales department and treat it as though it were an outside organization."

"My object isn't to pin the blame on anyone," said Kendall. "I'm simply using the best expedient to keep shop routine in order. Both foremen and salesmen are human, and as long as the salesmen have access to the shop they will interfere with production."

"A salesman works better if he feels close to the organization he represents," said Evans. "The psychological effect of being treated as a stranger will certainly dampen his enthusiasm."

■

What Do You Think About This Problem?

Most organizations allow their salesmen free run of the manufacturing departments. Other firms require them to obtain special permission or to await periodic inspections. Do frequent visits by salesmen interfere with shop routine? Is this serious enough to limit the salesmen's access to the shop with the feeling of estrangement which may result? What has been your experience on this question?

. . . Discussion
of Executive Problems

■

Is Incentive Necessary?

I hardly agree with Mr. Swenson, industrial engineer, of Perkins Machine & Gear Company, in Vol. 73, page 350. He states, as unfavorable conditions: "The unsuccessful ones were where the work was large and varied and the men employed were highly skilled."

In our machine shop, which is entirely a maintenance one, we have semi-skilled and highly skilled men. We realized that these maintenance men gave a much smaller percentage of their producing ability than their fellow workers in the production departments. In order to convince them that they could turn out just as good work in less time, we started an incentive system in the die-sinking department.

The various dies have certain similar operations. The time on these was easy to determine. We found that we could estimate closely enough on variables to set pretty accurate time limits. A schedule was then made out for several weeks, listing the dies needed and estimated time as to when they should be ready. If the whole schedule was completed on time, a bonus was given to each of the die sinkers. Although some individual dies are not always ready on the day set, the men catch up on others. We figure we reduced our die-sinking time by about one-third and dies are usually ready when needed.

After this system had operated successfully for some time, we took on the more difficult job of allowing a time to repair a press or drop a hammer. We found it necessary to set a provisional time limit estimated on the obvious repairs, and after the job had been dismantled and examined, to add an extra time allowance. A total time was then set and the company split fifty-fifty with the mechanic or mechanics the time saved. We believe that ultimately 75 per cent of our maintenance work can be done on a premium basis to the benefit of the maintenance men and the company.

—William D. Plumb, *Factory Manager, Fayette R. Plumb, Inc.*

Wholesale or Retail?

There are a number of good reasons why a manufacturer should not allow personal purchases through the purchasing department; also a number of good reasons why a jobber or wholesaler should not give discounts on purchases when he knows they are for personal use. The only time a discount of this type is justifiable is when the manufacturer is giving an extra large percentage to his jobbers and retailers. Very few of the old reliable lines give these preferred discounts, as their articles are priced right—sell right—and represent honest values.

Some good reasons for eliminating these sales are:

(a) The purchases are generally made by a salaried employee on the company's time, which detracts from the employee's regular duties; while he may save a few dollars for another employee, he may be doing so at the expense of several hundred dollars to the company.

(b) Company buying for employees is not fair unless extended to all employees, and this would require an extra purchasing staff in a large factory.

(c) The company assumes a credit risk, and if someone does not check up to see that each employee pays for his purchases, the employee is likely to become lax. This may happen when a senior executive has purchases made for himself, and a subordinate hesitates to dun him for payment.

(d) The manufacturer who does not furnish service on an article is not entitled to a commission on its sale, which is what the lower pay amounts to.

(e) Company buying for employees affects local tradespeople, and if the company's product is sold locally, a slump in sales is very likely to follow after the company starts this practice. —C. F. Staples.

Inspection or Discretion?

Whether or not a drawing is incorrect, it is wrong to rely on the judgment of one man, because not all inspectors have the same opinion. The proper thing to do is to go to the engineering department and confer with the designer and checker. If all three agree that the limits given are too close, the drawing should be changed.

This procedure does not take much time, and by following it, the drawings are always kept correct. This does not necessarily mean to "educate the engineering department," because sometimes the judgment of the inspector is not as sound as he thought it to be. It is merely co-operation, which is necessary in every business. Usually there is too much jealousy which prevents such co-operation.

—Alfred Loeffler, *U. S. Rubber Company.*

The Urge to Merge

Like many tendencies in industry today, intrinsically sound for those who initiate them originally, that of merging has become a fetish, in which the last to attempt it are often playing the childhood game of follow-the-leader. Even in national organizations, mergers are not as successful as their proponents prophesy in advance—bigness is achieved, but the dividend rate has a habit of failing to grow in proportion to size.

The small machine shop, like the small retail store, succeeds because of the personal service it renders. It's pleasanter to do business with the responsible head of the firm, who can render immediate decisions, than it is with a salesman or clerk, who must continually seek confirmation. The medium-sized shop inherits all of the disadvantageous overhead and complication of doing business, with relatively little of the economies of quan-

tity purchasing or mass production fabrication. There is a distinct field for the small shop—mere growing pains are not necessarily a sign of progress and ambition. The merger of small shops may combine many experts in one organization, but it usually fails to provide a big scale general executive or administrator. The history of many a merger is best read in the plants abandoned—entailing an overhead charge that is often prohibitive for future production to carry. Small shops that are successful dividend earners may well look twice before they leap and then face in the other direction.

—Lewis J. Yapp, *Design Draftsman, U. S. Naval Aircraft Factory.*

Jigs By Whom?

We have three interested persons, designer, producer, and salesman, with a host of intermediate problems to solve. Before we attempt to decide who should be responsible for jig design there is the question of volume. Is it sufficient to justify the use of drop-forgings and dies? Are wooden patterns all the volume will justify, or is it better to go after large volume and use more costly equipment?

It is safe to assume that, where there is a tool engineer, there is likely to be a wide gap between the designer and the shop superintendent. The superintendent is more likely to be an organizer than an expert on design, and is usually too busy to be of great help.

I can recall a cylinder design for an automobile engine sent on a rush order with no provision to support a water-jacket core or to remove the core when cast. This blueprint was checked and O.K.'ed, but it was of vital importance that the jacket core be supported and vented and provision made for its removal. The necessary openings were added when the omission was pointed out, and there was no hard feeling as I sent the blueprint to the pattern shop and telephoned the additions necessary to correct the drawing.

There are problems of metal stamping and forming where an ingenious designer has a job and the ability of a diemaker is a valuable aid. A tool designer can wait for a set of prints and get around most puzzles, feeling he is an expert, but one who can analyze a design on the first print and has the influence to get a hearing about his problems is to be preferred.

—James McIntosh.

Can Ideas Be Allocated?

Not only can engineering costs be treated as other manufacturing costs in the method of charging them against the product, but it is even possible to schedule engineering work in advance. It is not pretended that engineers and draftsmen, who have never worked with such a system, would hail such an innovation with enthusiasm—it is only human nature to oppose the restriction of a traditional privilege. Judgment must be exercised in its introduction—its findings should never be paramount to good production design. By the same token, it will be found distinctly useful in restricting unnecessary refinement in development design, where the proving of a new basic principle or combination of ideas at a minimum cost is the prime consideration.

The suggested use of the time clock, I believe, is unfortunate. There is an inherent aversion to it among designers and engineers. The same purpose can be accomplished by letting the individual write in his own time in hours on a daily job ticket, rather than to punch a clock. The clock suggests minutes, when hours are really all that are desired. Some sort of ticket must be provided anyhow—in order to identify the job—and the elimination of the time clock itself really saves time and temper.

To an engineering executive the system of keeping account of time is usually a revelation as to the value of the various men in his organization. The man who produces quality through continual redesign, recheck, and consultation with others, soon stands revealed in comparison to the man who gets an assignment, digs in, and bats it out in satisfactory form. There are of course innumerable objections that can be advanced against allocating time on ideas—but the executive who has the courage and the patience to insist will find that it can be done.

—W. F. Michael.

Too Much Specialization?

It seems to me that the superintendent was at fault for allowing his shop to get into such condition that it was necessary to use his operators to clean the chips away from their machines. Why didn't he employ the necessary laborers to keep the shop clean at all times and not wait until he was in a jam with an approaching inspection, so that he was forced to use operators?

A man who is on to his job can easily determine how many machines one laborer can keep clean. This may vary with every shop according to the class of work. In some shops, the cuts are very light, while in others where the cuts are heavy, a large amount of chips is accumulated every day.

—J. Walter Wright, *Assistant to the President, Wilmot Fleming Iron & Steel Company.*

Speculating in Personnel

The first step in determining what should be done about reducing the executive personnel is a thorough study of the normal demands on it. If the company has overbought in the executive market, so that in normal times the burden would be excessive, there are two solutions. The first is to cut loose the excessive supervisory personnel. But even when this drastic step is necessary, the keen farsighted president can accomplish much by judiciously selecting those whom he would keep on the payroll.

The company could provide for better times and save some of the present excessive personnel by inaugurating a plan to place some executives on lesser jobs with salary reductions. The most tactful way to do this is to talk with each man involved, telling him the necessity of the move and showing him that the company would pay him something more than was the regular salary on the job. The promise to advance him to his former position and salary when business permitted must be sincerely put across. This is the logical businesslike solution, especially with business ready to return to normal.

—E. E. Gagnon, *Mechanical Superintendent, Raybestos-Manhattan Company.*

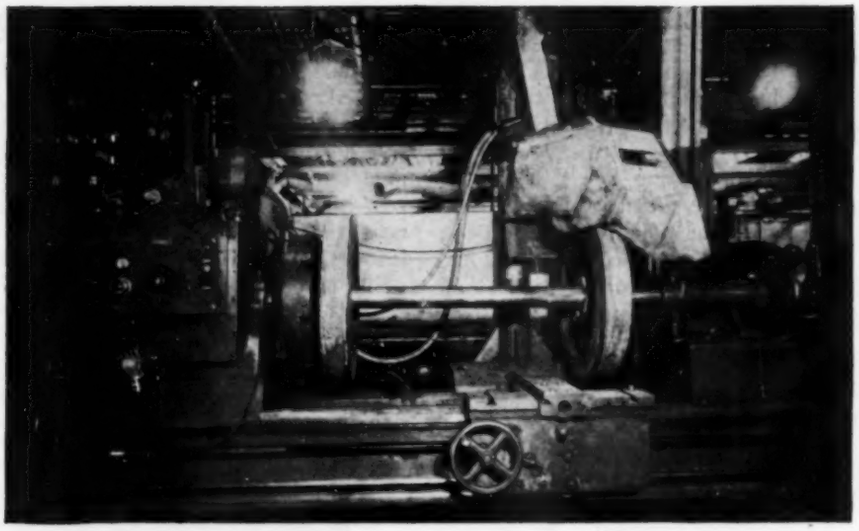


Fig. 1—An old lathe, reconstructed to turn carwheels while an automatic arc-welding unit, mounted on the toolpost, applies a continuous bead

▼

Automatic Arc-Welding Economies

G. H. Koch

General Engineer,
Westinghouse Electric & Manufacturing Company

THE USE of automatic machines in any industry or process is generally associated with lowered production costs or improved product. Usually it results in obtaining both, with an added advantage of uniformity. Aside from considerations of economy in eliminating manual skill, there seems to be a marked demand on all sides for machines to replace the trained eye and delicate touch of the artisan.

The reason for this industrial evolution is easily discernible. Physical aptitude requires extensive training to develop to the point of usefulness and reliability. In the form of trained workmen it is migratory and subject to the various ramifications of human relationship and existence. Products of different hands are not always interchangeable, even when made to the same specifications.

Now, arc welding is an art in the sense that the operator creates the finished product from raw materials. In the performance of his work he must exercise good judgment and muscular control. He must regulate the arc length constantly by eye and ear to maintain the correct arc voltage. His hand must be steady and must impart several distinct motions to the electrode holder in a uniform and prescribed manner.

These requirements, difficult for a welder, are easily filled by a machine. Elements sensitive to the arc voltage regulate the feed of the electrode toward the consuming arc to maintain a constant arc length between the end of the electrode and the work. Separate motor drives provide uniform motion for the arc along the seam and a weaving or oscillating motion across the seam where it is desired.

An automatic arc-welding operation is performed without attention on the part of the operator except for starting and stopping. In some production work even this can be done automatically by limit switches. Because of unchanging conditions, uniform results are obtained, and since the welding is continuous, a much higher production is assured than would be possible manually. This is partly a result of the fact that thermal conditions at the arc remain constant and the current may, therefore, be increased to the limit with a corresponding increase in speed for a given operation. Furthermore, since the electrode is fed continuously from a reel, there are no interruptions such as the manual operator introduces in changing electrode rods.

Most applications of automatic arc welding are made to replace manual arc-welding operations for increased economy and reliability. However, some applications are to replace the gas torch and the resistance butt-welder. This is particularly true in the joining of sheets too thin to be arc welded manually. The automatic arc can be extended to thin sheets because of its good control of thermal conditions at the seam. The saving over

gas welding is appreciable, not only in the elimination of the gas cost, but also in increased speed and decrease in thermal distortion of the work. Some operations, making use of resistance or flash butt-welding to join the edges of thin sheets, are beginning to favor automatic arc welding. This is particularly true on work requiring the removal of the welding fin on one side by grinding to prepare for the application of enamel or lacquer. Arc welding can be applied with the finish side against a backing or chill bar to limit the size of the fin. This, together with lower die maintenance, often more than offsets the increased speed of the resistance or flash butt-welder.

In this discussion the economy of automatic arc welding is considered with particular reference to its substitution for manual arc welding.

At first glance it would seem that the welding current could be increased indefinitely on a certain operation provided the welding speed were correspondingly increased to keep the total energy constant. In practice this procedure has a definite limit. In the first place, arc stability is of a very delicate nature, and an unstable arc is unsuited for welding purposes. Both increased linear speed and increased current tend to make the arc wild when carried beyond a certain value. This is brought about by small unbalanced magnetic fields around the arc, and light air currents and unequal ionization in the arc stream. In the second place, the current cannot be increased beyond the capacity of the electrode. The thermal capacity of an electrode is so small that increased current density must be accompanied by a shortening of the circuit in the electrode to the arc so that the I^2R heating does not exceed the permissible value. This is already done in automatic welding by providing a current-carrying contact between the electrode and the nozzle near the arc. The welding current flows through the low-resistance nozzle circuit into the electrode at the last point of contact, which is an inch or two from the arc itself. By shortening the current path through the electrode the current density in automatic welding may be raised to as much as 25,000 amp. per sq.in., as compared with 10,000 amp. for manual welding.

Comparative welding speeds for automatic and manual

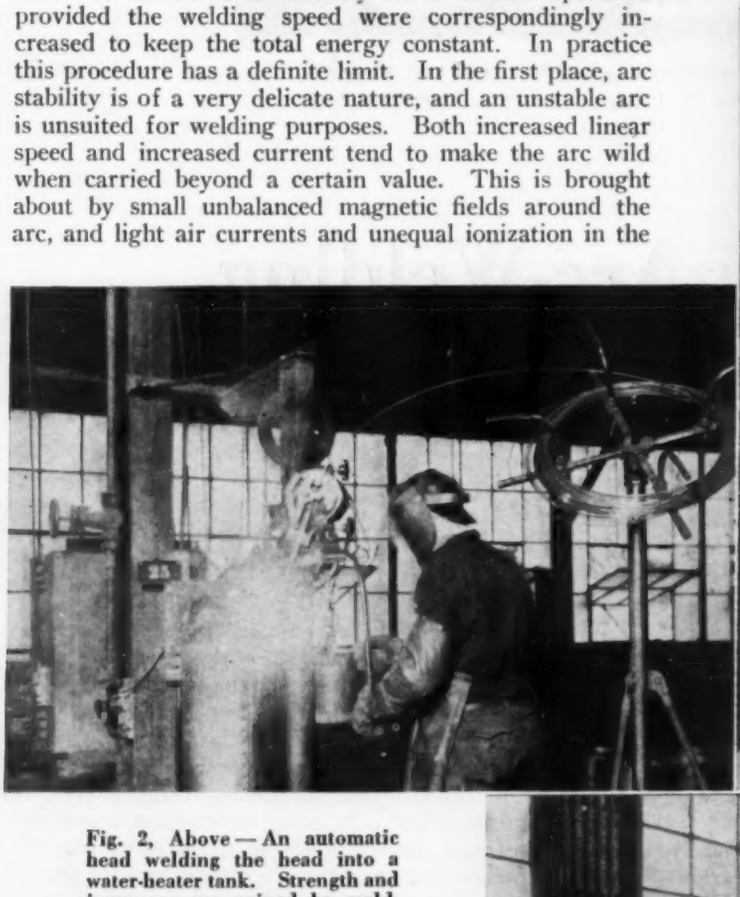


Fig. 2, Above — An automatic head welding the head into a water-heater tank. Strength and insurance are gained by welding behind riveted joints

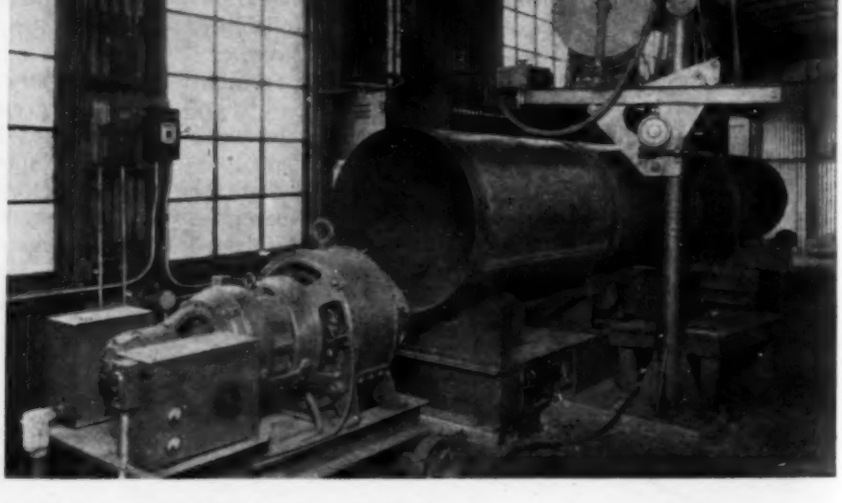


Fig. 3, Upper right—Welding both horizontal and circumferential seams in a tank

Fig. 4, Right — Joining sections of a well casing through butt straps by circumferential lap fillet welding

arc welding are now fairly well known for existing commercial electrodes. In general it may be said that simple continuous welds may be made with an automatic welding head in $\frac{1}{3}$ to $\frac{1}{6}$ the time required by an expert manual welder. The first figure holds for welds on material greater than $\frac{1}{4}$ in. in thickness, whereas the greatest time saving is affected on the thinner sheets.

ONE of the simplest applications of an automatic arc-welding head is in a repair shop to build up the surface of worn or undersize parts. Fig. 1 shows a typical example of such an installation. The gearing has been changed to lower the peripheral speed of the work to normal welding figures. Change gears provide a wide range of head stock speeds to accommodate various diameters. An asbestos shield with welding glass insert confines the rays so that the operation may be carried on in the open shop without danger to the other workmen. This illustration shows a pair of mining locomotive wheels. Mining locomotive tires have a tendency to groove in the tread because of the abrasive action of the dust on the rails. Unless they are built up by welding only one or two cuts are permissible before they have to be discarded. By building up the groove only a light finishing cut is necessary to true the wheel tread and flange for further service. Even manual arc welding has been found to be profitable in increasing the life of the tires. The automatic head deposits metal at three times the rate common in manual welding practice and, since the cross feed for the arc is provided by the lathe, the operator is left free to do other work while welding is in progress.

Welding speeds on the class of work in Fig. 2 vary between 35 in. per min. on 14-gage material to 18 in. per min. on 10-gage sheets for a good fillet weld. Electrodes from $\frac{1}{8}$ to $\frac{5}{32}$-in. diameter are used with current values from 200 to 300 amp. In this case, a water-heater tank is rotated by a small turntable while the automatic head welds the tank top to the shell.

There is a gradual increase in the use of automatic welding in tank shops for the production of larger tanks. Fig. 3 shows such an application. For the longitudinal weld the head support carriage moves along the horizontal bar above the tank, and for circumferential welds the carriage is held stationary and the tank is rotated. The illustration shows a $\frac{3}{8}$-in. head ready to be welded into a $\frac{1}{4}$-in. shell at the rate of 12 in. per minute.

Fig. 4 shows an application of circumferential welding to join sections of well casing. The welding head is supported from a separate pedestal arm to provide for adjustment in the vertical and lateral direction. The machine which supports and rotates the casing is of a special design to permit adding section after section to form a long cylinder. The end roller support for the casing is mounted on a small truck which can roll endwise on a track to shift the casing. Auxiliary rollers in the main structure of the rotating machine can be operated by a cam and lever lift to raise the casing off the transverse rotating rollers for ease in shifting the casing endwise by hand. Thus the complete casing can be moved back to make room for an additional section on the machine. Between the outer pair of supporting and rotating roller shafts are another pair spaced closely together to contact small work diameters. All four shafts are driven by a single motor and gear reduction to produce the same peripheral speed at the weld. In this manner any diameter between 6 and 48 in. can be held self centered without adjustment. Lap welds on $\frac{1}{4}$-in. plate can be made at the rate of 12 in. per min. on such work. Where commercial steels are used and the plates are pulled together tightly, still higher speeds are obtainable.

A LARGE percentage of the gas and oil pipes which are now spanning the country to carry our natural resources from the fields to centers of consumption are manufactured by automatic arc welding. One manufacturer using his own electrodes and process is producing this pipe in sizes between 10 in. and 22 in. in diameter and 40 ft. in length at the rate of 19 miles per day.

In Fig. 5, the head is used to make the lap weld on $\frac{1}{4}$-in. plate. A strong fillet weld with good appearance can be made at the rate of 12 in. per min. using $\frac{5}{16}$-in. electrode wire with 350 amperes.

The clamp-type seam welder is the more usual form of machine for the manufacture of short length cylinders by butt welding with the automatic arc. These machines are particularly adaptable for relatively small production shops since they will accommodate a large range of diameters and plate thicknesses. Moreover, they can be used to butt weld two plates together. Such clamp welders, used in a pipe shop on the West Coast, consist essentially of a main frame with a backing bar or anvil under the arc. Air clamping fingers press each side of the seam down against the backing bar independently so that the plate edge will be lined up and held in position during the welding operation. A self-propelled carriage with welding head and electrode reel travels along the seam to make the weld.

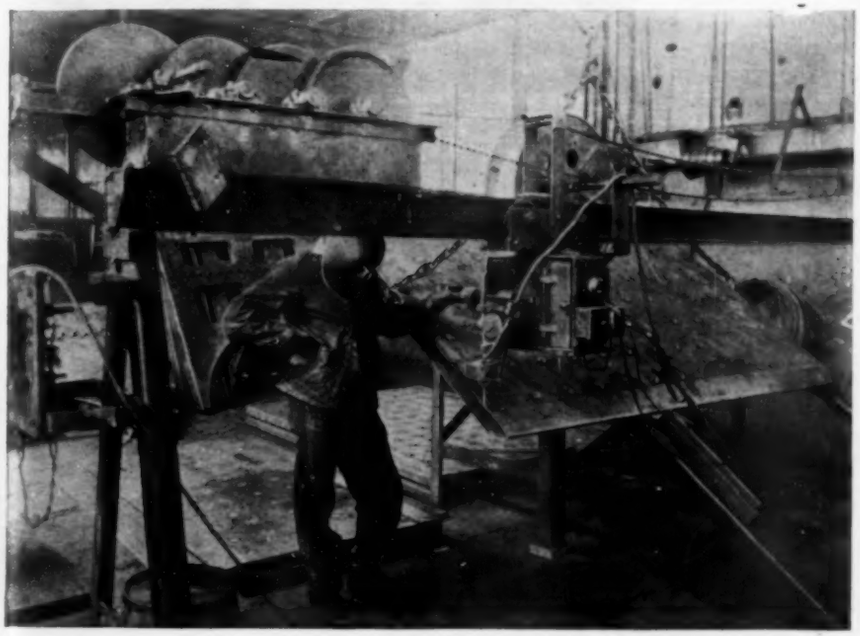
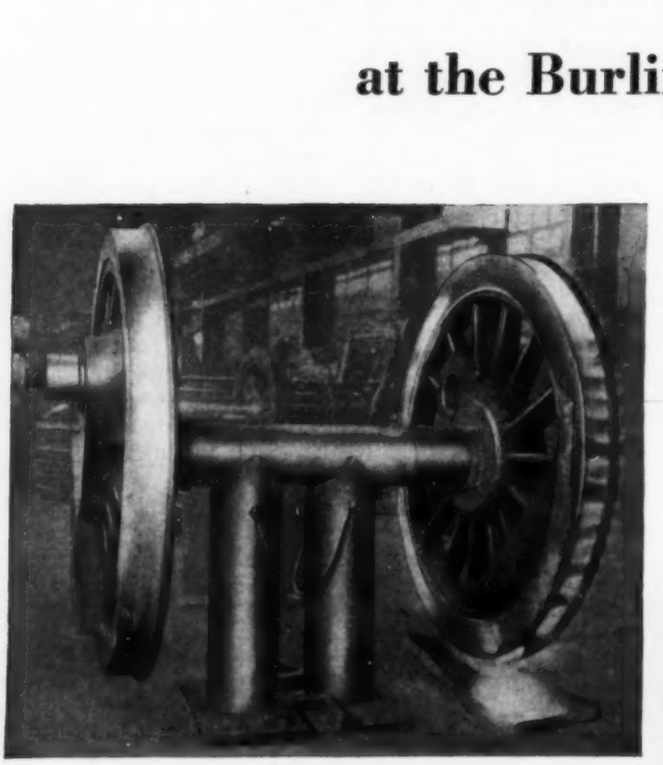


Fig. 5 — Making a lap weld on ¼-in. plate to be used in a low-pressure boiler

HANDLING WHEELS

at the Burlington Shops



Tires are removed with an oil-fired ring while the wheel sets are supported on pot stands

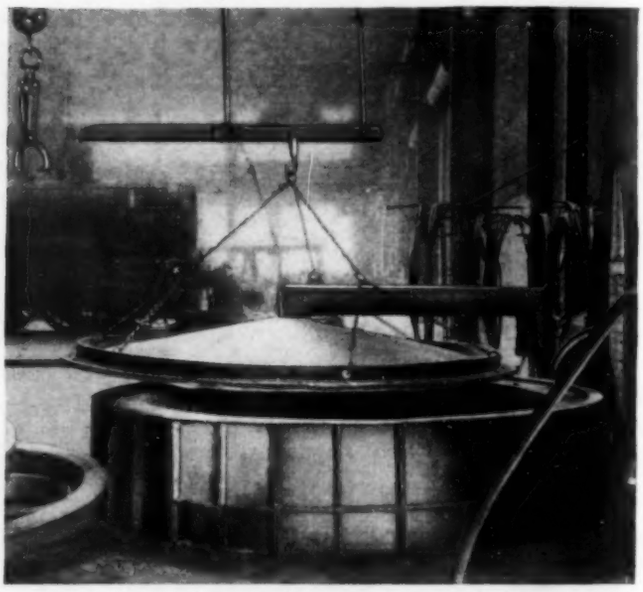
AT THE Burlington Shops in Denver, Colo., engines are de-wheeled at the rear of the longitudinal shop, and the wheels are brought over to the adjacent wheel bay by being rolled out into the yard, picked up by a cross crane, placed on rails running into the wheel shop, and pulled in by a cable attached to the overhead crane. This last procedure is necessary, as the crane obviously cannot extend into the yard on account of the cross crane. Not all this action takes place at once; usually, the wheel sets remain out in the yard long enough to have the journals whitewashed and the whole assembly given a thorough inspection in Colorado's brilliant sunlight.

When it is necessary to remove the tires, the wheel sets are placed on what might be termed pot stands. These consist of standards made of 10-in. pipe welded to flat steel bases, with saddle pieces welded on the open ends. For transportation about the shop, "bucket" handles, made of round stock, are provided. Tires are removed by heating with an oil-fired ring supplied by "distillate" with air pressure at 100 lb. per sq.in. This distillate is a crude form of kerosene and is ignited by oil-soaked waste.

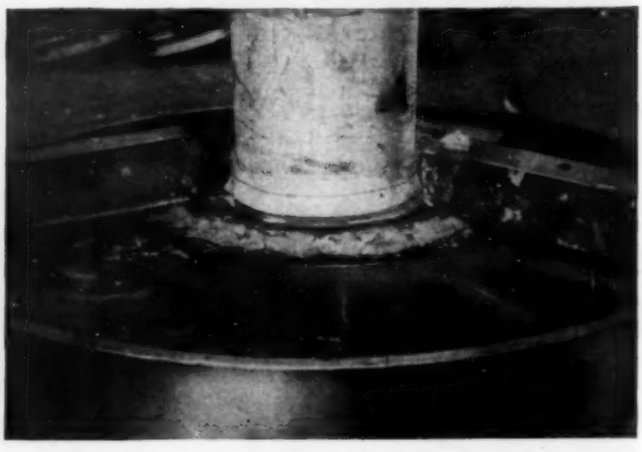
When new tires are put on the wheel centers, instead of hanging the tires on the centers and using the fire ring again, they are placed in an oil-fired furnace, and brought up to temperature. Generally eight to ten tires are stacked in the furnace at once. An air hoist on a monorail jib crane is used for handling the tires in and out of the pit by the aid of a pair of tongs. To remove the lid of the pit an arrangement similar to an inverted steelyard beam enables a man to lift it clear, hook it in a fixed vertical position, and swing it off the furnace.

Hub liners are renewed by casting new ones in place. The first operation is to remove the worn liner by chipping out with an air hammer, after which any broken holding plugs are replaced. These plugs, which are 1 in. in diam., have reverse taper heads for holding purposes

Oil-fired furnace for heating tires preparatory to mounting them on wheel centers

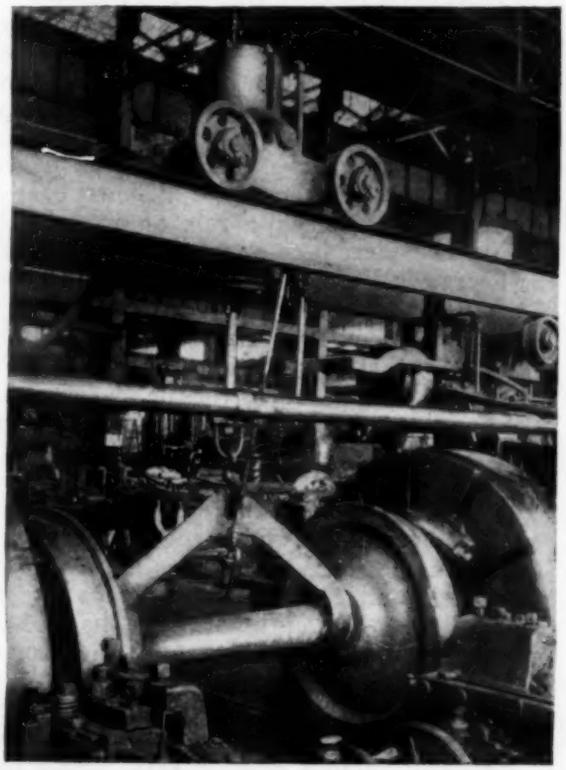


An asbestos band, sealed by asbestos plaster, forms a dam for the outer circumference of the cast brass hub liner

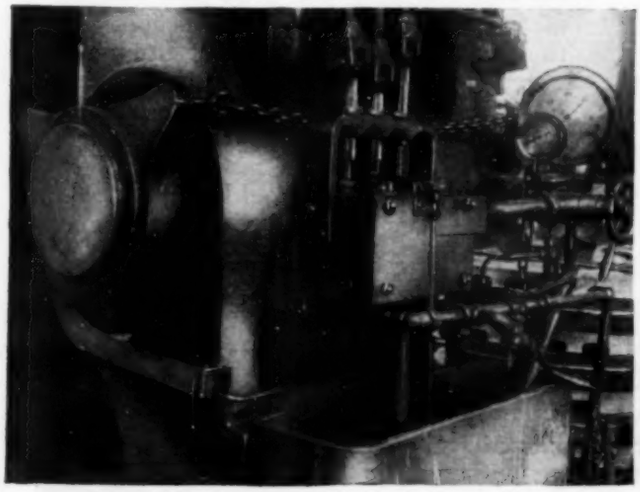


and are given a $\frac{1}{64}$-in. press fit in the wheel center. There are eight of them per hub. To pour the brasses, the wheel sets are upended, and a dam is constructed to limit the outer circumference of the cast-liner. This dam consists of a flexible asbestos band, turned on edge, held down by weights, and sealed with granulated asbestos soaked in water. Protection for the journal surface is obtained by wrapping several layers of an asbestos cloth tape, 2 in. wide, about the journal, and holding it in position by a soft iron wire. Generally, these liners are cast before the crankpins are pressed in, in which case the wheels rest directly on the concrete floor, but when the pins are in place, three cast-iron benches placed under the tires are used to obtain the desired clearance underneath.

A traveling pneumatic lift on top of this wheel lathe facilitates handling trailer, engine truck, and coach wheels in and out of the machine



By piping in water at ordinary shop pressure, rapid traverse of the ram of this wheel press is possible



The oil-fired furnace supplying the metal is located against the wall in line with other machinery in the wheel section, and the wheel sets are grouped conveniently about it. Turning of the sets, end for end, to cast the opposite liner is done with the aid of the overhead bridge crane.

On the opposite side of the bay, and close to the line of columns separating this section from the engine pits, is a 600-ton wheel press served by an 8-ton electric hoist on a wall jib crane. A series of parallel tracks in the floor enable wheel sets to be rolled over from the center of the bay, which is served by two 15-ton bridge cranes. This press has been rigged up with a rapid traverse arrangement whereby the shop water pressure of 150 lb. per sq.in. is called upon to advance the ram quickly to its working position. Then the triplex plunger pump is put into operation and the full pressure developed. A photograph shows the piping, as well as a sheet-metal trough used to catch the drip from the packing gland and return it to the reservoir from which the pump is supplied. Water from the shop system is introduced through the suction side of the pump.

Besides the equipment already mentioned, there are available for wheel and axle work: a 96-in. boring mill for tires, an axle lathe, a tire-turning lathe for trailer, engine truck, and coach wheels, a driving wheel lathe, one quartering machine, a gap lathe for trailer and engine truck axles, a 6-ft. radial drill, and three engine lathes, one used mostly for crankpin work. In this section, also, repairs are made to single and double engine trucks, trailer trucks, tender trucks and frames, driving boxes, and eccentrics.

■

The Theorist and the Practical Man

GEORGE H. GUNN

Aeronautical Draftsman, Naval Aircraft Factory, Philadelphia

THE practical man is not often in sympathy with the theorist. The former deals with known facts and is often skeptical of those who delve into mere theories. The practical man recognizes definite limitations and tends to accept them as final, instead of attempting to overcome them. The theorist, on the contrary, is like an explorer seeking unknown territory.

The practical man once said that metal-cutting tools would dull too rapidly if the speeds exceeded certain limits. The theorist recognized these same limitations, but began to think about possible improvements in the physical properties of tool steels. Eventually the practical man was supplied with alloy steels that retained their hardness at temperatures high enough to ruin the best carbon steel quickly. This metallurgical discovery made it possible to increase cutting speeds greatly and thus produce much more in a given time than was formerly considered possible.

But the theorist was not satisfied, and he began experimenting with other special alloys of an entirely different kind, with the result that further important developments in high-speed metal cutting have been made. The research work of the theorist will continue indefinitely along this and many other lines because he knows that mere theories often develop into good practice. It is evident, then, that the theorist who makes the theories of today the practice of tomorrow is a practical man himself.

The Foreman's Round Table

THE WAIL OF THE WEAK?

"SAY, AL, remember that superintendent's job I told you was going to be vacant?"

"Yes. What about it?"

"Well, this seems to be the open season on superintendents. Joe Black told me of another one that may quit."

"How does your friend get all his news, does he run a detective agency on the side?"

"Practically. He's got a big flock of stenographic relatives that work in the different offices in his town, and he gets all the news, historic, contemporary, and prophetic."

"He's fooling himself, boy. Everyone of those females is holding back the things she knows about her own boss, and telling things she doesn't know about others. But, as you were saying when you branched off—"

"I didn't branch off—you interrupted. It seems that one of the firms out there built a new factory and hired a new man to run it. In the old plant the chief engineer had charge of the whole thing, and when it came time to divide the responsibility in the new plant, he wanted either to keep both positions or be shop superintendent—like every comedian wants to play Shakespeare, you know. Well, the general manger thought he would make a better engineer, and hired this new man. Now things are in a mess, and the new man threatens to quit."

"A man who steps into a situation like that should expect trouble. The G.M. expects him to make radical changes without friction, and the poor fellow don't know whether to be a good egg or to do the thing he believes the G.M. hired him for."

"I guess maybe that's right. Joe says the chief engineer was easy going and a perfect gentleman, but his men took advantage of his easiness and the shop was not in very good condition. The chief engineer, however, says that the new man is disrupting the shop, that he is critical of the engineering department, and that he has killed all co-operation between the shop and engineering department."

"Which shows that there is sometimes a difference between a perfect gentleman and a good sport. We once had a purchasing agent that raised a commercial transaction to the dignity of a social function, but, nevertheless, he was not an ethical purchasing agent. The howl about lack of co-operation is always raised by men who don't know what the term means. My old boss, when he retired and bade good-bye to his foreman, said, 'Boys, as I look back I can see that I have made three major errors in management: I have looked upon system as a definite control, whereas it is merely a rule of procedure; I have considered co-operation an essential, whereas it is a deterrent; and I have mistaken arbitration for co-ordination.' I've always remembered that, and I don't want to work where co-operation is considered an essential. It's a crutch for the inefficient and a handicap for the efficient. It averages ability. What comeback did the new man have, any?"

"Joe says he told the G.M. that the shop was co-operating with the engineering department in the sense that it was improving the product, and either making things like the drawing, or having the drawing changed. It was this that caused most of the trouble, apparently. The G.M. asked him how the engineering department accepted such help, and the new man said that they accepted it without comment when it was clearly their fault, but expected the shop to remedy errors without changing the drawings, the way it used to be done, and they resented suggestions. The G.M. knew what the new man was up against and told him on the quiet to go ahead just the way he was doing, but under no circumstances to quarrel with the chief engineer. But he may quit."

"He's foolish. I would stick to a G.M. like that. You notice he didn't tell the superintendent to co-operate."

Was Al's boss right about one or all of his errors? Is Al, himself, right in considering co-operation as industrial charity? Does co-operation mean independent parallel operation, or merged activity?

▸ ▸ ▸ Discussion of Former Topics

Do Errors Cancel Each Other?

This subject, as discussed in the argument between Ed and Al, has two distinct parts to it. First, the fact that the inspector failed to catch the error of the workman, and second, that the management wants to charge the spoiled work against the workman.

The first part shows poor planning, if the workman did not have a blueprint or an order which stated definitely what pitch the gears should be. The production manager had better look his system over and correct it. Then the foreman should have had a preliminary check on Joe before he let him start to cut a hundred gears. Also the inspection department should not check work unless they have a blueprint or order to check against. So far, Joe is not the only one who has made a mistake. But actual practice in American industries will help us defend Joe and keep him from paying for the gears.

The National Association of Foremen has just completed a survey of 53 industries in the United States. One of the questions asked was, "Do you charge employees for spoiled work?" The replies came from factories large and small, from metal working, textile, woodworking, and various trades. And here's what they are actually doing today in hundreds of departments:

Thirty-two companies do not charge employees for spoiled work; 21 companies charge the employee for the actual time wasted in doing the defective work. In most of these cases the company only pays the employee for good pieces, and he therefore loses the time he used in making the bad parts. In other cases the company penalizes the man through the bonus system, by only paying for good parts, which actually reduces the man's earnings by reducing his bonus. In two cases out of the twenty-one the company charges the workman with labor and material wasted.

So Joe has 32 votes in favor of his claim for exemption and 21 against him. However, it is possible that among the 32 who said they did not charge the employee for defective work, there might have been some who forgot to say that they do not pay the man for defective work—paying only for good products passed and accepted by the inspection department. I believe this—that most companies today are leaning toward paying only for good work, and that Joe would have to either do the work over on his own time or have the time he wasted not included in his pay check. The customer today only buys good products, and good work.

—E. H. Tingley, *Secretary, National Association of Foremen.*

Boss, or Advisor?

All executives have met the man who mistakes an effort on the part of the foreman to give him a square deal as a display of weakness. In these cases it is necessary to be firm or even a little hard boiled.

On the other hand there are men, greatly in the majority, who are quick to respond to fair treatment. When shown that they are not playing the game according to the rules laid down, these men do not hesitate in doing the right thing.

Those of us who have been in the machine game for a number of years have probably worked under the type of man who adopts the policy that his is the supermind. He believes that, in order to get good results, he has to impress the men working under him with a sense of their inferiority in regard to both intelligence and position. If we remember our own reaction to this method, we know that Tom's dad was on the wrong track. For after all, a foreman's job is not so much to maintain his own dignity as it is to get the best results with the material that he has to work with.

—H. H. Vincent, *Machine Shop Foreman, Hupp Motor Car Corporation.*

From Soup to Nuts

A foreman should take advantage of every chance to get out in a social way and mingle with his brother men, even if it is necessary to be draped in a Tuxedo.

A man may be never so good as a mechanic, yet draw in his shell like a snail and not get much farther, relatively, than the snail. It wouldn't mean that the foreman who attended this anniversary or any similar occasion went just for the possibility of securing what is spoken of as "pull" but rather in the light of an educational enterprise for himself; also, perhaps he will educate his superiors to his abilities which, quite likely, would not manifest themselves over a long period in the routine of work-a-day life.

Ed shows himself to be a good old straight shooter. More credit to him than to the fellow that would attend anything that the high "mucky-mucks" put forward just because they fostered it. I have seen shops where, when an event was announced, the reply from men asked to attend would be, "Is Mr. So-and-so going to be there?" Mr. So-and-so being the manager of the plant, an affirmative answer assured a good turnout.

—Jack Sargent, *Foreman, R. Wallace & Sons Manufacturing Company.*

Keep Out

It depends upon the importance of the work in question whether changes should be made during the "super's" absence. Unless it is a matter of emergency, and highly important, no one should make any changes over the super's head and during his vacation.

The super being a good man, according to Ed, must have had his good reasons for re-arranging the sequence of operations, and it would probably cost the company more to override his instructions than to leave them alone until the man's return.

The real trouble, apparently, was lack of co-operation between the super and the production manager. Had they worked together as they should, the vice-president would never have been called in. The vice-president should have prevailed upon the production manager to

wait and should have taken the occasion to find out why there was any need of calling him in on the deal.

Assuming the V.P. had been convinced that the change was urgent enough for immediate action, he should then have called in the super and the production manager as soon as the super had returned and explained what had been done and why.

On the other hand, it would not have hurt the super to find out something about the alteration of his instructions and then have it out with the vice-president in a calm and sane way. —J. C. P. Bode.

The Safety Court

Do not the most of us blame the operator for being careless when it is our own fault for not making the conditions such that he cannot get hurt? It is hard work to do two things at once, and most of us lack the ambition to do more than one.

As I look over the practical letter section, I see some things that are distinctly dangerous if something should break, and other things that could be made much safer. At the present time, for instance, there is no reason or excuse for feeding parts under the ram of a press by hand. In other cases, slit material and a roll feed is not only safer, but will produce more. A little thought would make many machines safer. —Wm. Butzlaff.

Honest Graft

If a man does not value a chance to learn something without being paid for it, he isn't fit to hold a job of responsibility. The invitation to attend a study class or lecture should be enough inducement for any man of ambition to be glad to attend. I wouldn't give a man who doesn't take that much interest in his work standing room, to say nothing about paying him for his time.

The way to find out who your live wire key men are is to start a lecture or study class and find out the ones who are eager to attend. These are the men who will make your best foremen, in the majority of cases.

—Wm. Betz, *Master Mechanic, The Fafnir Bearing Company.*

Wrong Number

To the writer, the question involved is to make the distinction between the use and misuse of the telephone in business hours.

This problem was solved in a very satisfactory manner in an engineering concern by reducing the number of telephones having outside connections to two. These were placed in the main office near the operator where it soon became apparent that they were not to be used idly. Calls were taken for any employee and were listed. When an excessive number of calls was being placed for any particular employee that fact was apparent, and calling his attention to it was found to be sufficient to eliminate misuse of the privilege. In the writer's opinion, the use of the telephone, under proper restrictions, should be extended to all employees.

—Edward A. Myers, *Engineer, Langley Field, Virginia.*

When Personal Tools are Damaged

It is to be questioned whether skilled men, such as toolmakers and patternmakers, should bear the cost of renewal and repair of personal tools.

In favor of personal tools it may be said that they allow more time to be spent on actual work and less in waiting for an indicator which is in use. More pride, interest and accuracy are put into the work as a result of knowing the indicator is working correctly. The writer has had an indicator in daily use for ten years, with the renewal of only two glasses, whereas a new indicator put into use in the shop will barely last six months without some repairs. The point is: men of the tool making and pattern trades usually repair minor faults in their own tools.

—W. A. Harris, *Coventry, England.*

Playing Favorites

To show favor to one man who in point of ability is no better than his fellow-workman, besides being unjust, is the surest way for a foreman to lose the confidence of his men. Yet in every shop there are tasks that, while coming under the heading of "dirty" work, require the services of a capable machinist. It is obviously unfair to saddle one man with this class of work without extra remuneration to compensate for the extra wear on overalls, etc.

In a steel mill I know of, when a machinist is given an unusually "dirty" job, he is allowed a few cents extra on his hourly rate until the job is completed. This "dirt money," as it is called, helps to make up for the extra discomfort involved. Formerly the foreman concerned had difficulty in finding capable men for this work, but with the extra inducement this trouble disappeared. —Robert S. Alexander, *Universal Winding Company.*

Experience or Authority?

This case recalls the machine shop of a by-gone day when all operators were expected to make and grind their own tools and often to repair their machines, principally because there was no one else to do it.

The change-over began some thirty years ago, and the writer, as a machine shop foreman in those days, had many experiences similar to those related by Ed, but in every case authority took precedence and the operator either had to fall into line, or fall out. Should Ed allow this man to grind his drills and repair his press, then he must give similar privileges to everyone throughout the shop, thus taking a backward step. The operator in question may be all that he claims, but Ed has hired him to operate the drill press, nothing more or less, and the bargain must be kept. On this point alone must the matter be met and fought. If Ed makes this plain, at the same time pointing out that, although he himself may lack actual working experience of this drill press, nevertheless he is endowed with the necessary qualifications for a machine shop foreman, all should end satisfactory. If however, it is found that this operator will only work as an individual and not as part of the organization there is only one thing for Ed to do: fill in his quit slip as quickly as possible.

—F. P. Terry, *Belfast, Ireland.*

GROUP INCENTIVE for Quantity Production

W. G. HOLMES

Reduced Administration Costs Result From the Standard Time Plan of Group Reward

SO MUCH has been written and said on incentive plans that one hesitates to broach the subject anew. However, it is improbable that the last chapter on any phase of management will ever be written and any interchange of ideas that will stimulate progressive action is always appropriate.

During the past year or two, the group method of extra reward has come into prominence. For production work, it has advantages in lowering administration cost and in installing a spirit of co-operation among the workers. Two plans of group incentive are in common use which may be called the group piecework system and the standard time system. The present purpose is to weigh these plans one against the other and to point out several advantages over individual piecework.

It may be readily seen that where thousands of pieces are involved, the detail necessitated by an individual piecework system becomes burdensome. A complete stock count after each operation of each operator must be taken. This must be checked against a total record to insure that no more pieces per operation are paid for than the total completed. Timekeepers must record attendance, hours worked per operator, operator's piece price, operator's production on various operations, and operator's daily earnings. This data goes to the paymaster who computes the daily earnings per man. One copy is retained by the timekeeper and another goes to the production department. A statement is also given the operator. A constant and detailed supervision of piecework prices must be exercised by the time-study department to keep them in harmony with changes in shop practice and to make allowances for contingencies which arise from time to time.

Unless each operator is continuously supplied with work, his total productive time is not used, his earnings drop, and he becomes dissatisfied. Each operator must be guaranteed his base hourly rate, and when he is forced to wait for parts from the previous operation, he must be paid for his idle time. This method does not inculcate the operator's fullest co-operation when tool or machine trouble develops in the department. He feels that he will get only a certain amount of work to do in any event, and the habit of waiting for work is fostered. The operator is not required to learn several or all operations on the part and consequently does not make himself of general value except under direct supervision or when he possesses unusual initiative. The advantage of piecework lies in that it rewards each man directly for his individual skill, as he shares the results of his effort with no one. But since his supply of material is dependent on the pace of others, this benefit is not clearcut.

Group piecework consists in paying a specified price for all pieces completed by a group. Each day there is a definite allowed quota of incompleted pieces in process which the group is to maintain. At the start of a run,

the men performing the first operations start enough ahead of the others to insure a supply of work for the subsequent operations. An allowance is made for the time consumed in filling the department with incompleted work; this allowance is charged back when the run has been completed. This precaution avoids idle time although in small groups it may not be necessary. The earnings of each man depend on the number of pieces produced, the piecerate, and portion of the total time that is worked by the individual.

As before, a daily record of completed parts must be kept and checked against the total production. The timekeeper must also record attendance, number of hours worked by each man, group price, the number of pieces completed by the group, and the daily working hours of the group. This record is sent to the pay and production departments with a copy retained by the timekeeper. The paymaster computes the total earned from the report and makes out a statement for each man.

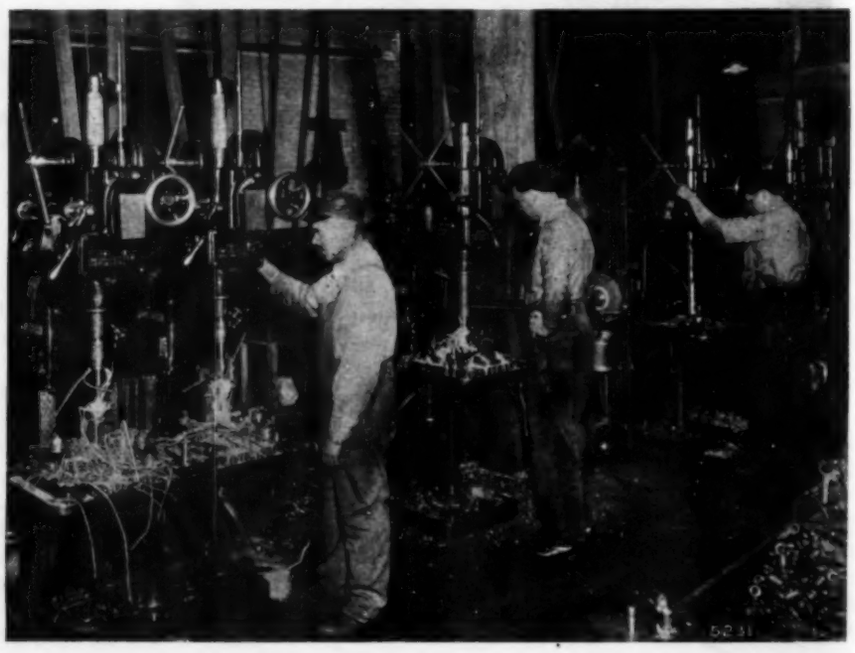
Supervision by the time-study department is not required for minor changes in method or trouble-causing contingencies. The allowance for these variations would be such a small proportion of the earnings of the group that the error is not appreciable. Major changes in operation or in the size of the group require the immediate attention of the time-study department. For groups of twenty or less the addition or removal of one operator will change the earnings by at least five per cent.

If an operator completes his work in one section of a group or if his machine is being repaired or set up, it is to his advantage to find other work. This occurs when the time cycle of one operation is less than that of another, a condition which under the individual piecework plan would result in idleness. This time may be used to train new operators or to relieve at definite intervals another operator who has difficult, tedious, or heavy work to perform. Each man is personally interested in getting machines back into operation when shut down for repairs or a new set-up. He may run a few pieces on another operation when the regular operator is temporarily absent. The lazy or inefficient man is forced to learn new methods to meet the approval of his foreman and fellow-workers. This condition leads to the development of initiative and leadership. When green operators are added to a group, they are given a nominal day rate while learning to prevent loss to the older operators. An objection to group piecework is the diminished incentive to the individual because of the distribution of the fruits of his effort among the group.

The standard time method of reward consists in adding to the base rate of each man an increase in proportion to the group efficiently computed as follows: the total number of hours consumed by the group is divided by the number of completed parts giving the time per part. The standard time divided by the actual time gives the efficiency rating. Each employee is paid a one per cent bonus for each per cent of group efficiency above 100. The statement of efficiency is kept daily by the time-study department from the total completed assemblies. This statement gives departmental ratings for the total time worked in the current pay period. Full-time employees receive their pay in accordance with the rating as of the last day of the period. Men quitting during the period are paid according to the statement of the last day worked.

A percentage, depending on the difficulty of the work or lack of organization at the start of new production, is added to cover the increased time required. When the group becomes efficient and has no problems which cannot be met by its own effort, the allowance is discontinued. Each department produces each day only the parts necessary to complete the assembly production quota and to maintain their allowed finished and unfinished stock. The investment in stock is thereby reduced to a minimum and an elaborate tally of detailed production, per operation, per small group is avoided. The only count required is the small finished parts stock and the number of pieces started each day. The object in setting a definite daily production is to give each department a definite goal as a certain amount of scrap or salvage parts will always be included.

WHEN necessary to alter the number of completed parts required, the number of workers is changed. The department is shut down when its daily quota is reached to obtain the maximum efficiency and to allow the operators to make the maximum wages. Since non-productive labor such as inspectors, truckmen, repairmen, and clerks is not permitted to work when the department is not operating, the expense jobs are held to a minimum and the day rate payroll is reduced. The method quickly reflects any inefficiency in the non-productive departments or in the department foremen since the productive operators must at all times be kept busy to attain high efficiency and increased earnings. Idle operators and low-ratings reflect a lack of executive supervision. If



Co-operation Among Group Workers Is Encouraged Without Neglecting Recognition for Individual Merit

stock is not on hand, the planning department or raw material department is to blame. Otherwise, the delay may be laid to a service department which has failed to obtain the necessary supplies or equipment. In any event, defects in non-productive departments become apparent.

All detail records of parts produced by individual operators or small groups are obviated. Timekeepers take charge of the clocks and record the total hours worked by each operator on his time card. By this method one timekeeper can keep track of from 600 to 700 operators. The paymaster computes each man's pay from the total hours worked during the period, and the group efficiency as of the last day worked and the individual base rate. The time-study department need cover the entire shop only once a year, the standard time being in a large measure a matter of estimate and comparison with the last similar jobs. When the standard is set too low, the efficiency rating is not up to requirements—when too high, earnings are excessive or the operators are idle to prevent excessive earnings. When the latter condition arises, the standard time may be reduced to the advantage of both the operators and the company. If an operator has not been required to work with diligence over a period of time, he is likely to quit when required to produce at full efficiency, and the company loses a valuable worker. When the required production for a department cannot be met in the estimated standard time, and when an analysis shows no idleness nor means for improvement, the standard time is increased. The yearly time study of productive departments furnishes records to establish standard times for obtaining the fullest economy.

In addition, this method provides a convenient means of executive control. The superintendent has a daily record of trouble in any department by noting its rate of efficiency. Excessive costs are currently brought to light whereas cost department records would not be available until much later. By charting the premium groups, it may be readily discovered whether enough or too much labor is employed. If the chart shows production below requirements, but a normal rating, more men should be added except for temporary conditions when overtime may be advisable. Excessive production must be controlled by reducing the number of operators.

All the advantages of the group piecework system are retained in the standard time method. In addition, exceptional merit or individual initiative may be recognized by increasing a man's base rate. It will be noted also that this method eliminates much of the detail work necessary in either the individual or group piecework plans. The large number of departmental timekeepers may be reduced to a few clock attendants who merely keep attendance records without detailing separate operations or the efforts of individual operators. The work of the pay department is simplified as one efficiency factor suffices for each group and may be readily applied to each man's base rate and hours worked. The time-study department is relieved of much production rate setting and may act in a development and advisory capacity. The workers themselves profit through the flexibility of the varying base rate which considers individual merit. This can be effected without increasing the cost per piece as the average departmental base rate is retained, each rate above average being balanced by a corresponding one below it. Paper work, stock counting and checking, and a multitude of minor records and adjustments are effectively avoided.

The advantages of the standard time plan as compared to either piecework plan may be summarized as:

1. Production increased from 25 to 35 per cent.
2. Operators' wages increased from 10 to 15 per cent.
3. Personal contingencies, tool set-ups, and machine care reduce the operator's efficiency to from 70 to 90 per cent of normal for piecework plans. When standard time is employed, the incentive produces maximum co-operation at all times.
4. Since the group is paid only for usable parts, scrap material is reduced. Each operator is on the lookout to avoid lost group time on rejected pieces. The standard time does, however, include a percentage to cover foundry or vendors' scrap, over which the group has no control.
5. The increased efficiency requires a lower initial investment in each department as much duplication in equipment is unnecessary.
6. Departmental time keeping booths are eliminated. Time keeping expense is only $0.01 per operator per day, as compared to $0.032 by the booth method.

It is realized that no incentive plan is sufficiently universal to fit all types of manufacture. For quantity production however, the group method using standard time has proven itself to be the simplest and most effective yet devised. It creates interest and co-operation in the men working under it without the disadvantage of a high administrative cost.

■

Inspection Tours

MORTON SCHWAM

PRECISION instruments are often donated by manufacturing concerns to large universities in order that the future engineers may become accustomed to the use of such instruments and order that type when out in the engineering field. These same concerns should extend invitations for inspection tours through their plants to the senior classes of universities. Such tours will enlighten the students as to the possibilities of the field, and in that manner attract them to that particular branch of engineering.

The tours should be planned so the visitors will derive the most benefit, by dividing them into groups of five to ten each, led by members of the engineering department. Many of the larger concerns have realized the value of such tours, making the inspection of two or even three days in duration and closing the tour with a dinner for the visitors on the last day. Another method, which some concerns have followed, is to have a moving picture taken of an inspection tour. The films are loaned to universities, thus giving the student who could not afford to take the trip, the value of such an inspection tour. With the development of sound films, such a method could be greatly improved as the tour could be explained as the picture progressed. The sound effects of the machines in the shops could be reproduced in order to make the tour more realistic. Of course, the moving picture inspection is not as beneficial as the personal inspection inasmuch as the visiting party may want to ask questions concerning various operations which could not be answered unless a representative of the concern were present.

AMERICAN MACHINIST 1930 INVENTORY

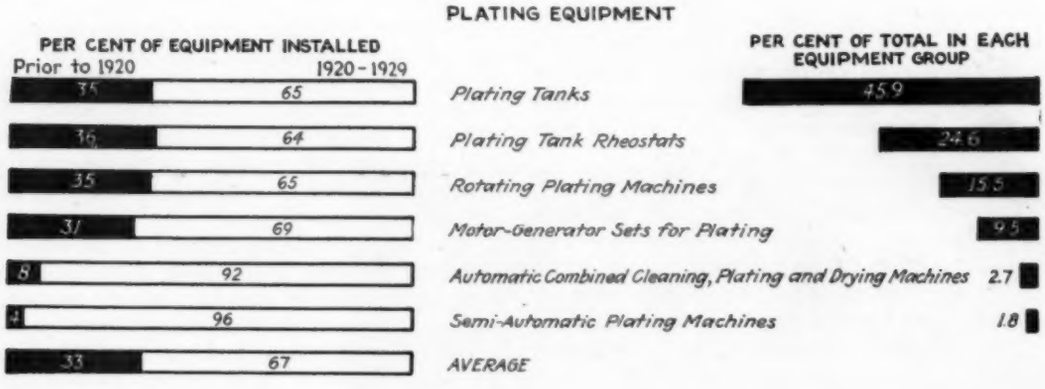
of Metal-Working Equipment

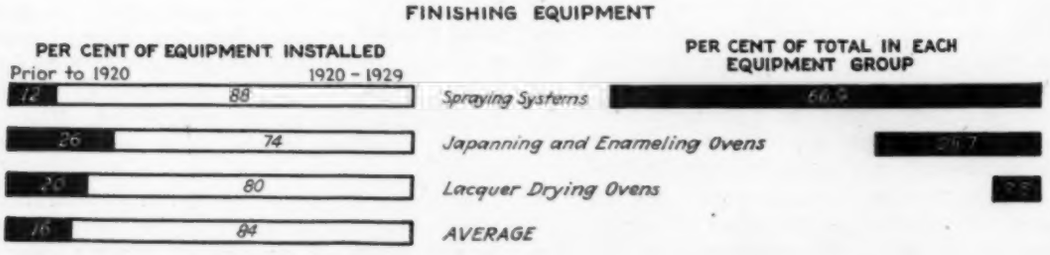
Report No. 10—Plating, japanning, enameling, and lacquering equipment in industrial plants

AS OUTLINED in the introduction in the present series (Vol. 73, page 267), the questionnaires forming the basis of the 1930 *American Machinist* inventory were broader in scope than those used five years ago. In 1925, only machine tools were included. The present compilation covers furnace, finishing, foundry, and plant service equipment. Unlike the machine tools, these auxiliary groups are each reported as a whole instead of dividing them into industries. Report No. 5 in Vol. 73, page 471, showed the ratios of old to new furnaces of various types. The present report is the second covering an auxiliary group. Since no similar count was made of plating and finishing equipment five years ago, a direct comparison is not possible.

The averages for both plating and finishing are considerably lower than the 44 per cent of machine tools over ten years of age reported in 1925. This may be partly attributed to the shorter life of this equipment and partly to the advances made in plating and finishing methods. The subdivisions of plating equipment have a remarkably uniform old-new ratio with the exception of the two smallest which comprise semi-automatic and automatic machines. Since these two groups represent relatively recent developments, the eight and four per cent over ten years old reported for them is not surprising. However, these groups combined form only 4.5 per cent of the total plating equipment.

Finishing equipment over ten years of age has an average percentage of only 16, even smaller than for plating: Spraying systems comprise almost 67 per cent of the total and show only 12 per cent over ten years of age. The longer life of drying ovens increases the percentage of old equipment for the entire group.





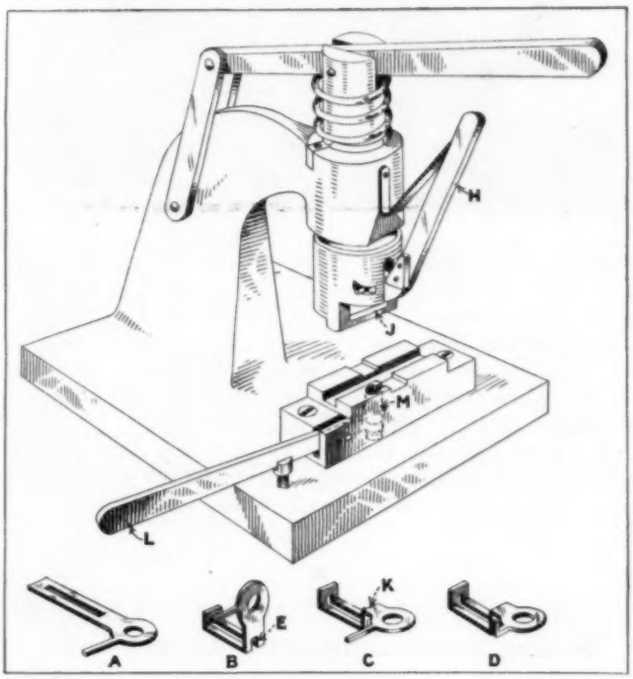
IDEAS FROM PRACTICAL MEN

■

Fixture for Difficult Bending

CHARLES H. WILLEY
Assistant Plant Superintendent, Hoyt Electrical Works

A LARGE quantity of parts of 0.020-in. semi-hard brass, such as the one at *A*, were to be bent to the form indicated at *D*. Three operations were required, all being performed in the same fixture, the successive bends being shown at *B*, *C*, and *D*. While it might be supposed that all of the bends could have been made at one stroke of the punch, such is not the case. In experimenting to try making the bends at one stroke, we found that the slot would close at the point *E*, which was fatal to the experiment. All the bends are sharp at the corners, and



therein lay the trouble, for semi-hard brass of such thinness does not seem to lend itself to being bent with so many sharp corners at one movement.

Finally, we designed and built the fixture shown in the illustration, the frame of which is a standard one for many of our tools. The operations are as follows: The blank having been placed in the nest in the die, the punch is brought down by the lever at the top, making the bend indicated at *B*. While this lever is held down by the fingers, lever *H* is pushed inward with the left hand and held by the thumb of the right. This brings the slide *J* out of its pocket in the punch and making the bend indicated at *K*. Without releasing either of these levers, lever *L* is pushed down raising the plunger *M*, bending up the small tongue, as shown at *D*, the slide *J* acting as a bending block for this operation.

A girl operator can make all the bends at the rate of 500 pieces per hour. While the device appears to be the most practical one we could have made for the purpose, it would be interesting to know how other toolmakers would arrange to handle the work.

■

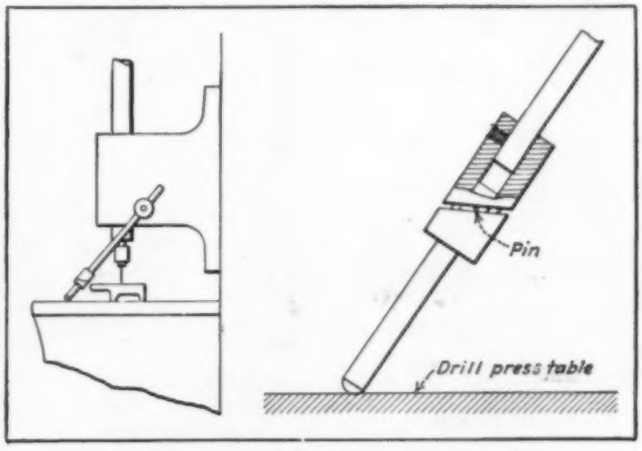
Rigid Feed-Attachment for the Drill Press

HARRY MOORE
Hamilton, Ontario, Canada

While small drills of about the No. 50 size do not cost much to replace when they are broken, the cost of removing the broken parts from holes is sometimes considerable. It will be apparent to anyone with experience that the breakage of small drills usually occurs just when they are coming through the work. The reason, of course, is the impossibility of regulating the pressure on the feed lever to suit the decreasing resistance of the work to the drill after the point has come through. The result is that the drill comes through suddenly, leaving jagged fins at the bottom of the hole. The flutes of the drill catch in the fins, and the drill is broken before the machine can be stopped.

Recently, being confronted with an excess breakage of drills, I devised the attachment shown in the illustration, by the use of which the breakage has been almost entirely eliminated. The attachment, as shown in the illustration, consists of a sleeve, an extension lever, a small pin, and a setscrew. The sleeve is drilled to fit both the feed lever and the extension lever, and is slotted about halfway through diagonally to fit a small pin driven into the extension lever. At the right is an assembly of the device, while at the left it is shown in place on the drill press.

In operation, the work and the table are so adjusted that the end of the extension lever will strike the table just before the drill is about to break through the work. When that moment arrives, the operator rotates the



Device to prevent breakage of small drills

extension lever to the right, keeping its lower end in contact with the table, thus moving its upper end farther into the sleeve by the riding of the pin in the diagonal slot, and allowing the lower end to advance on the table. This movement is imparted to the feed lever, bringing down the drill as fast only as is permitted by the movement of the extension lever into the sleeve. Thus the feed is under control, and the drill will come through the work gradually, without danger of being broken.

■

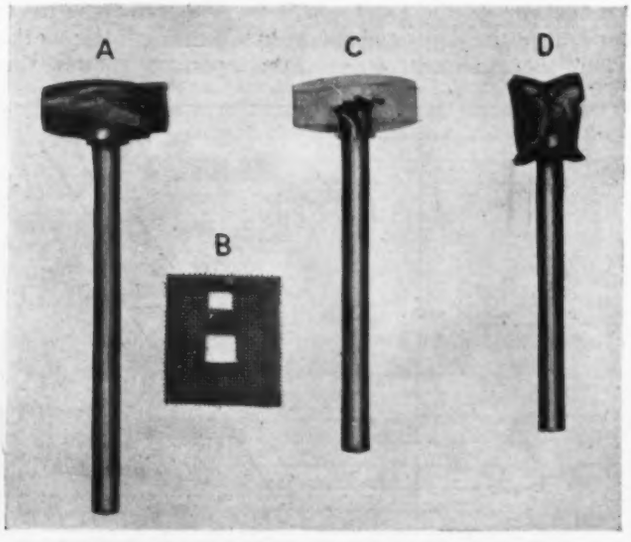
Safe Soft Metal Hammer

W. D. CREIDER
Manager, The Oilgear Company

A large percentage of accidents and near accidents have been caused by the use of lead or babbitt hammers. Recently, after one of the near accidents, I designed a soft-metal hammer that I believe is worthy of comment, with the object of possibly avoiding accidents from its use.

In the illustration, at *A*, is a partially-cast hammer in which hardware cloth of eight mesh is used as a bond. The wire with which the mesh is made is very soft and thin. The piece shown at *B* has two rectangular holes cut in it. It is then rolled into cylindrical shape and is inserted in the mold near the outside. One of the holes is to allow the handle to pass through, and the other is to permit the molten metal to flow to the outside. The handle is a piece of pipe, flattened and flared at the end about which the metal is cast. At *C* is a longitudinal section of a bonded hammer head, showing in two rows the ends of the wires in the mesh. A bonded hammer that has had hard usage and has outlived its usefulness is shown at *D*. It will be noted that the metal in the head, while battered out of shape, is still all there.

In casting hammer heads of either lead or babbitt, the material is sometimes used over and over to such an extent that it becomes brittle, pieces of which are likely to fly off when the hammer is in use. Also, that the metal from which they are cast is not always hot enough, resulting in the heads being cast in layers, instead of in a solid mass. In use, large pieces of such hammer heads are likely to fly off and cause accidents. The use of wire mesh as a bond will prevent any such occurrence.



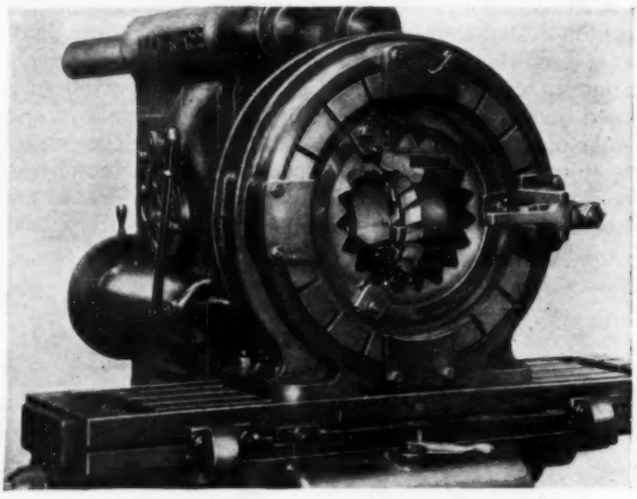
Constructional views of a soft-metal hammer, the head of which is strengthened by a bond of wire mesh

Internal Gear Fixture

CHARLES C. MERZ
Vice-President, Merz Engineering Company

The illustration below shows rather an unusual set-up on a Milwaukee milling machine. The piece to be machined is an internal cut gear, and when we first took on the work, we thought it would be possible to accomplish it on a Fellows gear shaper. However, we found that the tooth depth was greater than anything built by the Fellows Gear Shaper Company. Through force of circumstances, we built this fixture because we knew of no other method to perform the job.

The part that fastens to the two overhanging arms is a large iron casting, carrying a pair of gears mounted



directly to the standard drive of the Milwaukee mill. Two diamond chains connect this cross shaft to the cross shaft that carries the cutter. Each of the diamond chains has an idler sprocket with an eccentric to take up the stretch and wear. The indexing fixture, mounted on the table, has roller bearings to enable the index to be turned easily.

We have used this device approximately eight months and find it very satisfactory. It produces an accurate gear with a very smooth finish on the teeth.

■

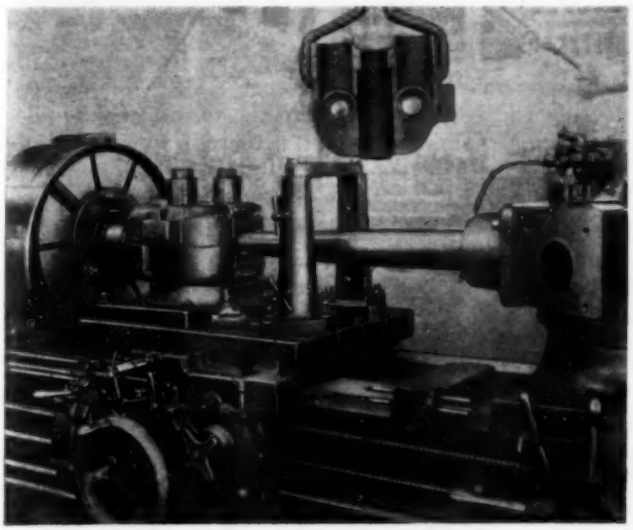
Boring Operations on a Turret Lathe

H. P. LEONARD

A turret lathe in the plant of the Gardner-Denver Company, Denver, Colo., has been rigged up with special tooling and fixtures to bore a series of three holes in two steel castings that are similar in form. Both are die blocks for a rock drill sharpening machine. In the illustration, a pair of upper blocks is shown being bored: the lower die block is essentially the same except that the casting has a tail piece, which receives additional clamping by the setscrews on the upright standards mounted on the rear of the lathe carriage. In each instance, the castings are bored in like pairs.

As can be seen from the finished piece shown suspended from the crane hook there are two vertical holes besides the three longitudinal bores in each piece. These

have been previously bored and reamed to size in a special horizontal boring machine and serve as clamping and locating points. The fixture carrying the piece in the carriage is extremely simple, consisting as it does of a circular plate and two detachable upright studs



closely fitting both the body of the fixture and the castings as well. Spacing sleeves on top under the heads of the clamp bolts take care of the variation in height between the upper and lower die blocks.

The unit is shown set up for boring the long central hole. In this instance, the long boring bar is piloted in a bushing carried in a casting bolted to the turret face, and its other end, which is tapered, is keyed to a driving member bolted to the faceplate. Obviously, the boring bar remains fixed axially as it rotates, and feed is obtained by means of the carriage, which advances the work through the cutter.

For boring the short holes on either side of the center, a stub spindle with flat cutter is slipped into the tapered socket of the driving member, and the cross-slide is shifted either forward or back to bring the casting to the proper centers as determined by stops built into the cross ways. These stops are brought into action by a small lever at the front.

■

Shrinking a Collar Tight Against a Hub

V. T. Root

We had to place a comparatively narrow steel collar on a shaft so that it would be tight against the hub of a pulley that was keyed in place. Taking everything into consideration, it was thought best to shrink the collar on the shaft, rather than to press it on. However, as the ordinary shrinking operation would result in a small space being left between the collar and the hub as the collar cooled, we adopted the following method:

The collar was bored with a 0.002-in. taper. After being heated, it was placed on the shaft with the larger part of the bore next to the hub. As the collar cooled, it was slightly dished, due to the taper bore, bringing the outer edge tight against the hub. The collar was made $\frac{1}{16}$ in. wider than was wanted, to allow for facing the dished surface flat.

Cutting Worms Without a Lead Screw

J. T. Towlson
London, England

It is quite probable that most lathe hands have, at some time or other, cut worms of fairly quick lead in lathes having no leadscrews, or in lathes where the change gears did not provide for as quick a lead as was necescary. However, the job can be quite easily done, as can the cutting of short, diamond screws under the same conditions.

In a shop with which I am closely familiar, hundreds of worms and diamond screws used in the manufacture of automobile tires, were cut in a screwless lathe. Having provided a master worm, or a master diamond screw, one of them was mounted on the same mandrel with the blank to be threaded. It was then necessary only to provide a guide of the proper shape to fit in one of the thread spaces of the master tool, whether it be a worm or a diamond screw, and to attach it firmly to some part of the carriage, and to be sure that the longitudinal feed is disengaged.

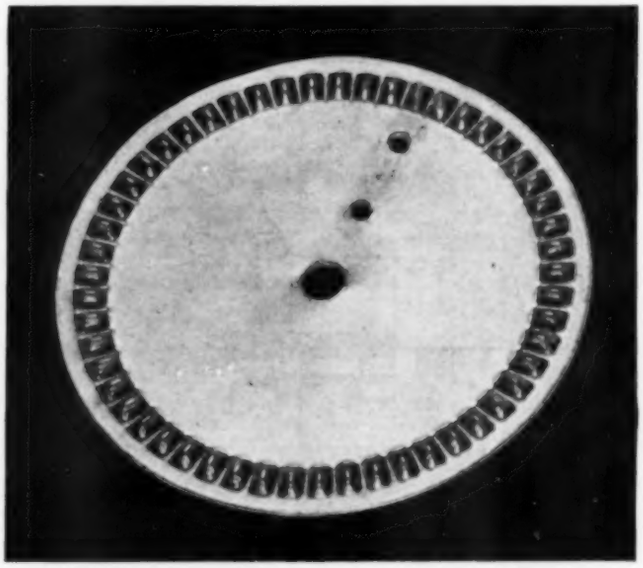
With the guide in mesh with the master worm, and with the lathe in motion, the carriage will be traversed in the direction of the lead, and the tool in the toolpost will follow the thread lead of the master worm. It is, of course, necessary to draw out the tool and to reverse the motion of the lathe at the end of each cut.

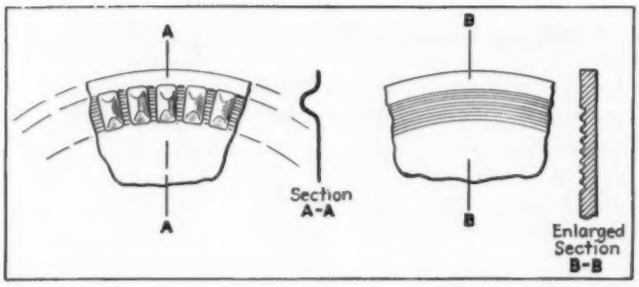
■

Eliminating Cracks in Metal Drawing

Charles E. Laue

We experienced difficulty in forming the teeth in the sheet-metal driving gear of a popularly-priced egg beater, a segment and a partial section of the gear being shown at the left in the illustration. Our trouble was that the metal, both at the tops and between the teeth would crack during the drawing process. To eliminate the trouble, fine circular indentations were stamped in one side of the blank in the place where the teeth were to be formed, as shown at the right. The section *B-B* is en-





larged to show the form and the number of the indentations. When forming the teeth, these indentations facilitated the flow of the metal, entirely obviating any breaks or cracks.

■

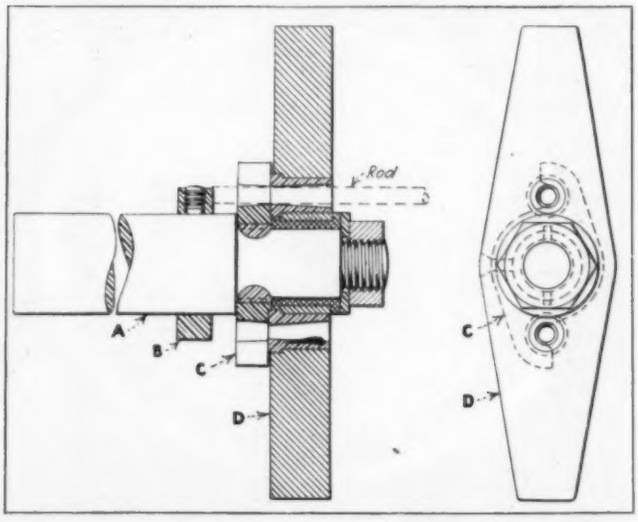
A Rotary Rod-Cutter

C. E. SCHINMAN
Production Engineer, Aero Production Company

A tool to be used in a lathe for cutting rods or wires into various lengths is shown in the illustration. Its construction is as follows: To the shank *A* is adjustably attached the stop collar *B*, which may be set in various positions to gage the lengths to be cut from the rods. The cutter *C* is keyed to the shank against the shoulder. Hardened bushings of diameters to suit the rods to be cut are carried on each side of the center of the crossbar *D*, which is centrally bushed with a bronze bushing that is a running fit on the small end of the shank. The outer end of the shank is threaded. A nut holds the assembly.

In operation, the shank is held in the lathe chuck. One end of the crossbar is rested on the carriage to prevent it from revolving. When the lathe is running, the cutter revolves past the bushings in the now stationary crossbar. The rod is inserted through one of the bushings, the inner end being pressed against the stop collar. The revolving cutter then cuts off a piece of a length determined by the position of the stop collar. At each revolution of the lathe, a piece is cut off.

The inner faces of the hardened bushings project slightly beyond the face of the crossbar. Thus, as the pieces are cut off and are carried past the bushing, they are free to drop clear of the cutter.



SEEN AND HEARD

●

Shortening Work Travel

ONE OF THE THINGS we have learned from the automobile shop is to arrange a shop so that work flows in parallel lines to the erecting or assembling floor. The normal volume of output, if there is a normal, determines the exact layout and the length of the machining lines. But the idea is being followed in shops of various kinds with good results. In one shop the distance traveled by one unit of the product was reduced from over a half mile to less than five hundred feet. It costs real money to move material, and a long line of travel may also tie up a lot of material in the production line.

—*J. R. G.*

New Taps and Large Holes

ONE READER writes: "In our factory, we have a large number of jobs requiring holes to be tapped for hardened screws. The jobs seldom run over two hours with about sixty to a hundred pieces to a lot. The tapped holes range from $\frac{3}{16}$ to $\frac{3}{4}$ in. in size.

"Our practice is to get a small number of screws from stock and select one that fits the thread gage snugly. A piece of scrap is then drilled and tapped and the screw tried. When a new tap is used, the screw is always loose. It is then necessary to stone the cutting edges of the tap to make the outside diameter smaller. Several stonings are required before the tap is ready, which in the course of a day, may take an hour's time. We use high-speed ground taps. Isn't it possible to buy standard screws and new taps that will thread holes to fit them?"

—*J.*

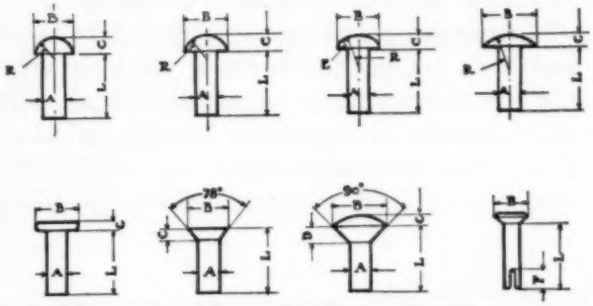
Melting Points

CHEMISTRY, and its twin brother metallurgy, afford great opportunities to the young man or woman who has imagination and perserverance. For while two and two always make four in mathematics they are likely to make any old thing in chemistry. Taking solders as an example, we find that certain mixtures of lead, bismuth, tin and cadmium will give melting points that range from 550 to 130 deg. F., yet none of the four metals named melts under 450 deg. F. Sulphur is another material that has peculiarities of its own. For we are warned not to heat it too hot for pouring lest it become so thick that it runs very sluggishly. —*J. R. G.*

New Equipment in Tool Shops

SOME machine tool builders, at least, are taking their own medicine and replacing old machine equipment with new. Nor are all of these in the newer sections of the country, supposed by some to have a monopoly on progress. A recent visit to two well known, old established shops showed large additions of new equipment, and more coming. A few machine foundations were empty because one of the new machines was doing much more work than any single machine it replaced. The only way for any shop to hold the lead in its field is to keep its machine equipment thoroughly up-to-date. —*J. R. G.*

Riveting Aluminum and Its Alloys



Kind	Diam. A	Width B	Head Depth C	Head Radius R	Edge Radius E	Ctsk. Depth D	Tube Depth F
Button Head	A	1.75A	.75A	.885A	..	..	..
Round Head	A	2A	.75A	1.042A	..	..	..
Mushroom Head	A	2A	.625A	1.634A	0.54A	..	..
Brazier Head	A	2.50A	.50A	1.8125A	..	..	..
Flat Head	A	2A	.4A	..	..	..	..
Ctsk. Head	A	1.81A	.5A	..	..	..	..
Ctsk. Oval Head	A	2.50A	.5A	1.8125A	..	.75	..
Tubular Shank	.140"-.187"	.375-.4375	..	..	..	..	.25

Common aluminum and aluminum alloy rivets

RIVETING is readily applicable to aluminum and its alloys, the fastenings in general being like those used in other metals except for certain minor deviations.

Rivets are made from most of the commercial wrought aluminum alloys, as well as from commercially pure aluminum. Ordinarily, they should be of the same composition as the sections they join. Rivets of commercially pure aluminum (2S) and of the aluminum manganese alloy (3S) are formed from annealed or from intermediate tempers of wire or rod stock, those from the intermediate tempers being the stronger. Most commonly used high-strength alloy rivets are made from 17S alloy wire or rod stock, and must be heat-treated before they can be driven satisfactorily. As in steel work, rivet head shape usually is governed by the job or by appearance desired. If appreciable tensile stresses are induced in the rivet, however, a rivet is used whose head height at shank circumference is not less than ½ shank diameter.

Frictional resistance in the riveted joint is commonly neglected in design, only tensile, shearing, and bearing strength of plates and rivets being considered. For example, in a single-riveted lap joint, the relation between sheet thickness, rivet diameter, and rivet pitch should be such that the net plate tensile strength will equal rivet shear strength. In other words, the area of sheet between rivet holes multiplied by sheet tensile strength should ordinarily equal the area of the rivet (after being driven), multiplied by its shear strength. There may be some question regarding selection of the correct rivet shear strength value because of the indeterminate amount of cold working in heading up. Unless specific data are available, design should be based on an assumed ratio of 0.6 between rivet shear and sheet tensile strengths.

This ratio gives the most economical pitch of rivets for a given sheet thickness and rivet diameter. In a properly proportioned joint, the greater the rivet diameter for a given sheet thickness, the greater the pitch of rivets and computed joint efficiency. As with other metals, multiple-row riveted joints give increased efficiency.

That a high ratio of rivet diameter to sheet thickness is desirable to gain maximum joint efficiency is true only within certain limits, beyond which the bearing strength of the sheet becomes the governing factor. As a general rule, design stress in bearing for most alloys may be taken as about 20 per cent greater than design stress in tension. It follows that rivet diameter should not exceed 2.5 times sheet thickness in order to prevent sheet crushing.

Marginal distance from the sheet edge to the center line of the nearest row of rivets should not be less than 1½ times rivet diameter where caulking is employed. Where not caulked, a greater marginal distance decreases the tendency for the sheet edge to become wavy. In multiple-riveted joints, the transverse pitch or distance between rivet rows should be about 75 per cent of the rivet pitch. Some of these suggestions do not hold where hot-driven steel rivets are used in high-strength aluminum structures, the principal difference being in the ratio between steel rivet shear strength and aluminum plate tensile strength, which will depend upon the alloy used; a value of 0.80 should be used for 17ST plate.

Aluminum rivets should be driven cold where possible. Those of heat-treated alloys should be driven within one or two hours after heat-treatment for satisfactory heading up. Rivets of 17ST, driven directly after heat-treatment, gain full mechanical strength in about four days. These recommendations do not hold for larger sizes of alloy rivets because of pressure required. Rivets larger than ½ in. in 17S and similar alloys are heated uniformly to the heat-treating temperature (940-960 deg. F. for 17S), then driven as quickly as possible. Thus heat is drawn from the rivets rapidly enough to give them almost full heat-treated properties. When a number of large hot steel rivets are driven in rapid succession in heat-treated alloy, water or compressed air prevents plate overheating.

To fill the hole properly and form a good head, rivets must be driven with heavy blows, otherwise the end will become surface hardened before the head is formed and the hole will not be filled. Squeeze-type riveters are preferred where possible. Light hammers operating at high speed, or a spinning tool utilizing a rotating holder fitted with rollers having the contour desired, are used when heading rivets through hollow sections.

To punch aluminum plate without burrs, proper clearance measured on the radius should be about one-eighth plate thickness. Holes should be punched undersize and reamed to size where high stresses are encountered. Spiral-flute reamers are best, steel reaming practice being followed. Steel riveting practice is also followed in determining clearance between rivet and rivet hole. Greater care should be taken than with steel in machine riveting to prevent crushing the plate, and rivets should be driven at random rather than progressively to prevent metal flow, particularly in the softer alloys. Pressures required to form button-head rivets, in lbs. per sq.in. of shank area, are: 2S, 200,000; 3S, 230,000; 25S, 380,000; 51S, 270,000; 17S, 480,000; A17S, 320,000; B17S, 320,000.

The amount of stock required to form a head varies with type of head, length of rivet grip, and clearance between rivet and hole. Under average conditions, the amount required to form flat, round, or button heads equals about 1¼ times rivet shank diameter; for mushroom heads, about twice shank diameter.

Abstracted from "The Riveting of Aluminum and Its Alloys," by permission of the Aluminum Co. of America.

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Where High Trade-In Allowances Failed

ALLOWING too much on a trade-in is a familiar and favorite fashion in cutting prices. According to all the rules of reason it must work, or sellers would not indulge in it. But do the rules of reason apply?

The sales manager of a certain company, who did not believe that it was necessary to cut prices in order to get business, was finally persuaded to let down the bars. Against his better judgment he permitted his salesmen, for a period of thirty days, to double the regular trade-in allowance.

With enthusiasm the salesmen went to work. In the thirty days allowed they brought in a total of additional business exactly equal to zero. In this instance, at least, the fallacy of the belief that price cutting stimulates business was clearly proved.

Reasoning from special cases to general conclusions is not good logic. On the other hand, the immortal Benjamin Franklin, in his memoirs, admits that his most successful method of argument was to point out one special case that failed to follow the general rule laid down by his adversary, thereby casting doubt on the proclaimed principle.

You can reason this one out any way you please, but there is one sales manager who is convinced that high trade-in allowances are not only unnecessary but futile. His experiment ended with the thirtieth day and will not be repeated.

Another Side to the Picture

IN A recent statement regarding production we read that "supplanting of human hands by machines reduces the cost of the product and thereby enlarges the market." Just how far this is true depends on the product and on other conditions. If the product is one bought by the men or women who are supplanted, their dismissal directly affects the market, at least until they get another job. It also affects the market for luxury articles indirectly, because many buyers of luxuries get their income from purchases made by the workers who are supplanted.

Unemployment, either from the introduction of new machinery or from a business depression, affects the market for general products. The use of labor-saving machinery is bound to increase and is an undoubted benefit in the long run, but the full benefit can only be attained when those supplanted by machines can be absorbed in other occupations without serious delay. Here, then, is one of the biggest problems industry has to solve.

Faith in Future Machine Building

GETTING ready for increased business isn't a gesture or propaganda in some of the shops recently visited by members of the editorial staff. Even though immediate orders have not been pressing, shops are being rearranged for more economical production, machines are being put into prime condition, and new equipment is being installed.

Those who seem to enjoy looking at the business future with deep blue glasses would do well to study some of the preparations being made for increased production a little later. And those who are inclined to be pessimistic as to the future of machine building may well be encouraged by the faith being shown by some of the oldest builders who are investing in new buildings and equipment.

Standardization Helps Sales

STANDARDIZATION, as has been pointed out so many times before, helps sales by making it easier for users to try new and improved equipment. The converse is shown in connection with welding machines whose equipment does not interchange; their lack of standardization makes necessary the carrying of spare parts for each make of welder. This has a tendency to discourage trying new and improved equipment because it entails scrapping both the old machines and any unused spare parts.

Milling machine builders have shown the way in standardizing their spindle noses. The practice may well be followed in welding and in many other fields.

SHOP EQUIPMENT NEWS

De Vlieg Automatic Duplex "Supermil" Milling Machine

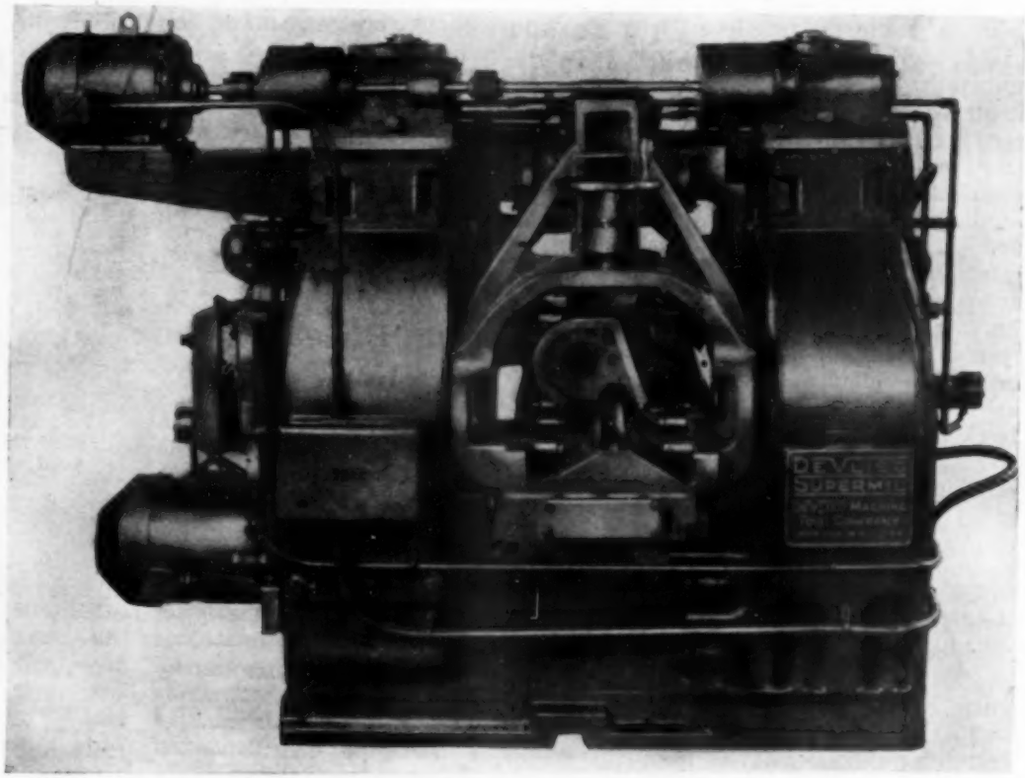
An automatic, multiple-spindle milling machine, suitable for incorporation in conveyor-type production set-ups, has been announced by the De Vlieg Machine Tool Company, Jackson, Mich. This duplex "Supermil" has both fixed and automatic disappearing spindles, so that the milling requirements on such work as cylinder blocks can be handled with one set-up. Automatic co-ordination of the vertical and table feeds produces a "U"-shaped cycle. Employment of tunnel-type fixtures on such a machine avoids the use of overhead handling equipment.

Both the construction and the speeds employed on this "Supermil" are suitable for the application of tungsten-carbide cutters. These cutters can be run at the rate of 300 ft. per min., and a feed of 25 in. per min. Thus, production of 25 finished eight-cylinder blocks per hour can be attained.

The machine illustrated is set-up for an eight-cylinder block with the crankcase half and bell ends cast integral. On this block there are two major pads, at the upper portion of the cylinder head, and they present a continuous surface in the same plane. They are milled by the plain adjustable fixed cutter spindles on each side. Below these plane surfaces are a number of small pads and bosses on each side of the crankcase. Because of projections in the path of the cutters, it has been necessary to fit the machine with automatically disappearing spindles. Furthermore, on each side of the crankcase is a second row of bosses behind the center interfering projection, these bosses being at different heights than those machined at the first half of the cycle. The fixed spindles are of the usual quill mounting with ample adjustment for cutter wear. Boring bar type disappearing spindles are also employed, their movement being controlled by hydraulic cylinders, actuated by No. 1 Brown & Sharpe gear pumps.

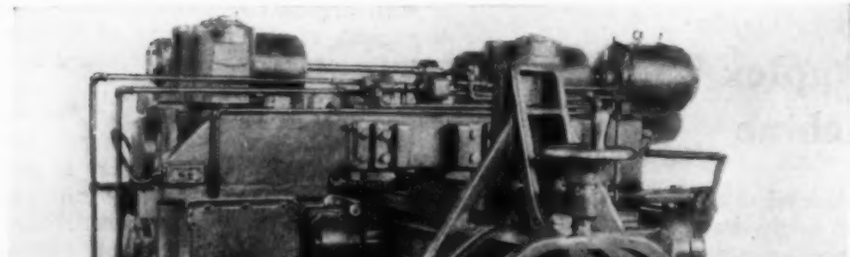
The structure of this "Supermil" follows the standard DeVlieg design, with duplex columns, hardened and ground, steel table ways of V- and flat construction, and a standard feed mechanism, using the regular hardened and ground feed screw for the longitudinal table movement. For the vertical movement, there is provided a pair of motor-driven feed units, each using a standard, hardened and ground screw, the same as employed in the main table feed. The vertical feed motor is directly connected to these units and the raising and lowering of them is actuated by electrical controls through a reversing switch. Controls for the hydraulic cylinders are operated by cams mounted on the top rail of the fixture. Each cam in turn operates push rods controlling the forward and reverse positions of the oil valves. A separate push rod and control is required for each disappearing spindle.

With the table positioned in the extreme position as shown in Fig. 1, it meets the conveyor, and the block is rolled into position against an approximate locator. A single lever drops the rolls, allowing the block to rest on hardened plates. Simultane-



De Vlieg Automatic Duplex "Supermil" with the table run out for the start of the cycle. Disappearing spindles, actuated by hydraulic cylinders and controlled by cams, permit milling bosses on both sides of an obstruction in the same set-up

Rear of the De Vlieg Automatic Duplex "Supermil," showing the table about to release a finish-milled cylinder block to the conveyor.



ously, two locating plugs register in the two holes in the block. Clamping is effected by means of handwheels at each end of the upper part of the fixture. Air clamps can be substituted, however, so that the operation can be performed from one end of the fixture only. With the block in position, one of the feed levers is engaged, which starts the vertical motor and thus feeds both heads to the lower position. After this the table feed is engaged automatically and starts milling longitudinally. At the completion of the longitudinal portion of the cycle, the table feed trips out and starts the vertical motor automatically, lifting the heads to the upper position and completing the milling cycle. The fixture clamps are then released and the locating plugs dropped. Simultaneously, the rolls are raised by means of a lever and the block is slid on, the table in this extremity meeting the conveyor on the opposite side. The operator then engages the power rapid traverse, returning the table to the starting position.

Smooth cutting is obtained by the rigid mounting of the work in the machine. The regular De Vlieg V- and flat hardened ways are aided by a guide rail at the top of the fixture, so that the work is guided firmly at both top and bottom. Thus, no marking or step is visible in the change between the vertical and horizontal feed. It is claimed that variance in the amount of stock to be removed on each side of the machine will not cause signs of variance in the finish or cut. The guide rail engages members faced with hardened steel, mounted on the bridge member between the two heads.

The entire machine is automatically lubricated. The breadth of application of this type of varying cycle with disappearing spindles is such that the product designer has greater freedom in his designs, without the penalty of lessened production.

"Aremite" High-Strength Iron

An electric furnace iron has been introduced to the trade under the name of "Aremite" by Robbins & Myers Sales, Inc., Springfield, Ohio. This iron has a tensile strength that can be varied between 30,000 and 50,000 lb. per sq.in., depending upon the hardness desired. At the lower limit, a Brinell hardness of 165 is attained, with corresponding ease of machinability. The microstructure of this material is similar to that of malleable iron, the distribution of graphite particles being quite fine.

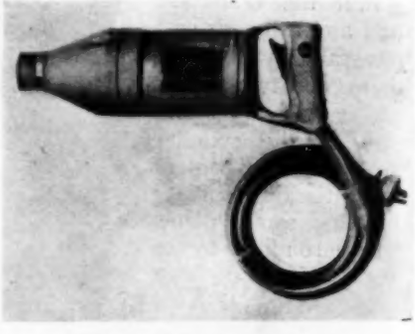
"Aremite" has been successfully substituted for many castings formerly made of cast steel or malleable iron, at a lower cost than either, and at about six times the normal speed of delivery of malleable castings. Electric furnace processing and subsequent heat-treatment make possible properties which are easily produced. It is said the material is cast as easily as common gray iron.

Brill "Multi-Tool"

A wide variety of attachments can be used with the "Multi-Tool" announced by the J. G. Brill Company, Philadelphia, Pa. This not only means economy in initial cost, but permits systematic crib distribution of attachments.

The hollow spindle is so constructed as to accept the square-ended shafts of the various attachments and tools. It holds them securely in place by a governor controlled coupling. When the power is shut off and the spindle comes to a stop, the governor weights return to normal position, and thus the tension is removed from the stirrup-type springs holding the attachment shaft in place. The attachment can then be removed from the power unit by hand.

The outer shell of the Multi-Tool is made of cast aluminum alloy. The



Brill "Multi-Tool," which can be fitted with a wide variety of attachments

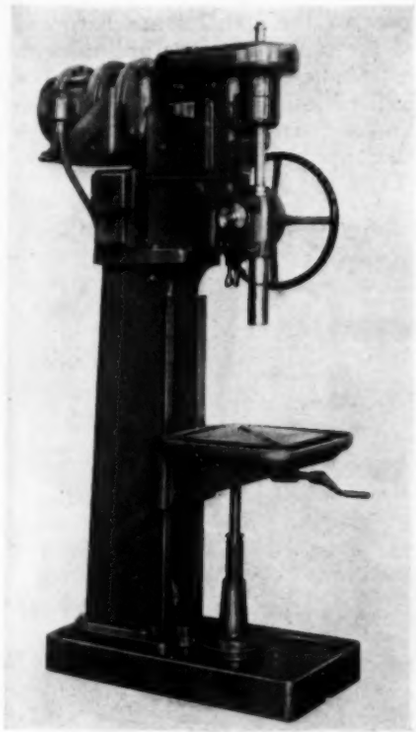
standard $\frac{1}{4}$-in. size tool is equipped with a $\frac{1}{6}$-hp. universal motor for either 110- or 220-volt circuits, four ball bearings, a center-spindle-type drive, and a pistol-grip handle. The last carries a trigger switch with a visible "off and on." It is complete with a three-wire extension cord

10 ft. long and a two-piece plug. Two of the cable wires supply the current and the third acts as a ground. The tool weighs 7¼ lb.

An octagon is provided on the outside of the lower spindle housing for holding some of the various attachments in the position best suited for the work to be performed. More than fifteen major operations can be performed by the use of the one power unit. These include drilling, grinding, buffing, sanding, sawing, nut setting, screw driving, planing, filing, valve grinding, reaming, under cutting, nibbling, shearing, and mixing. In railroad repair shops, it is particularly adapted to cleaning the front ends of locomotives and the outside of smoke boxes.

Barnes No. S-201 1-Inch All-Geared Drilling and Tapping Machine

Production drilling requirements can be met with the No. S-201, self-oiling, all-geared, drilling and tapping machine announced by the Barnes Drill Company, 814-830 Chestnut St., Rockford, Ill. It has a capacity for ⅜- to 1-in., high-speed drills in steel, and the distance from the center of the spindle to the face of the column is 10¼ in. Speed changes can be made quickly to give spindle speeds from 69 to 1,296 r.p.m. Feeds range from 0.0035 to 0.031 in. The gear case cover holds the pick-off gears in position on the six-splined shafts. Removal of the cover permits the exchange of gears. No nuts are used in this construction. Geared thread leading feeds for all tapping work can be provided.



A large steering-wheel-type handwheel is furnished on the Barnes No. S-201 Self-Oiling, All-Geared Drilling and Tapping Machine

The unit head contains a pump for the self-oiling system. This type of construction can be used in gang-style machines of any number of spindles. The column is of box section design and the head is bolted thereon. Raising blocks or longer columns can be employed where greater distances are required between the spindle nose and the table or base. A separate, direct-connected, motor-driven pump is employed for coolant when desired.

Driving keys for the spindle are eliminated by the use of six-spline construction, the spindle being carried in a ball thrust bearing. No. 4 Morse taper is furnished as standard, but No. 3 can be had at extra cost. Alloy steel gearing is employed throughout and all the gears are heat-treated and tempered. Six Timken bearings carry the pick-off gear shafts, these bearings being lubricated automatically. A 3-hp. motor is direct connected to the drive shaft, and may be

Specifications:

Capacity, in.	⅜ to 1
Height of machine, in.	88½
Distance, center of spindle to face of column, in.	10¼
Maximum distance from regular table to nose of spindle, in.	37½
Maximum distance from base to nose of spindle, in.	47¾
Spindle travel, in.	10
Diameter of spindle, driving end, in.	1⅜
Vertical travel of regular table, in.	17
Floor space, front to back, in.	44
width, in.	20

Wappat Heavy-Duty Drills

Efficient use of high-speed twist drills is claimed for the line of heavy-duty drills brought out by Wappat, Incorporated, Electric Tool Division of Simonds Saw & Steel Co., 7522-26 Meade St., Pittsburgh, Pa. Universal motors are employed. All shafts are carried on precision ball bearings. Three-wire cable is used on all sizes of these drills for safety, the third being a ground wire attached to the

inside of the frame. An extra-capacity, double-pole, momentary-type switch insures the tool against switch troubles. Stream-line design is employed to obtain good balance and to enable the drill to be used in corners and tight places.

Oxweld No. 23 Aluminum Welding Rod

The Oxweld Acetylene Company, 30 E. 42nd St., New York, N. Y., has introduced "Oxweld" No. 23 aluminum welding rod for welding either aluminum sheet or castings with the metal held tightly in jigs. At temperatures just below their melting point, aluminum casting alloys possess very little strength and have a high contraction co-efficient. The combined effect of these two properties may under certain conditions cause cracks to occur adjacent to welds. The No. 23 welding rod is recommended for

welding these alloys, because the melting point is lower than the metal being welded, so that it will remain in the molten state after the base metal has solidified. The weld metal will therefore fill in any voids that may have been created by the solidification and contraction of the base metal. Stresses which may be caused by contraction will be shifted from the base metal to the weld metal which, being free from hot shortness, will absorb the stresses without the development of cracks.

Oxweld No. 23 aluminum welding rod coalesces readily with all the aluminum alloys and possesses high strength and good corrosion resistance. It should always be used with Oxweld sheet aluminum flux. The rod is now available in three sizes, 1/16, $\frac{1}{8}$, and $\frac{1}{4}$ in.

Gleason 18-In. Hydraulically Operated Testing and Lapping Machine

Both spiral bevel and hypoid gears can be tested and lapped on the 18-in. machine developed by the Gleason Works, 1000 University Ave., Rochester, N. Y. After the gears are placed on the spindles, the machine is entirely automatic in operation. It is hydraulically operated, and the automatic features and timing are electrically controlled.

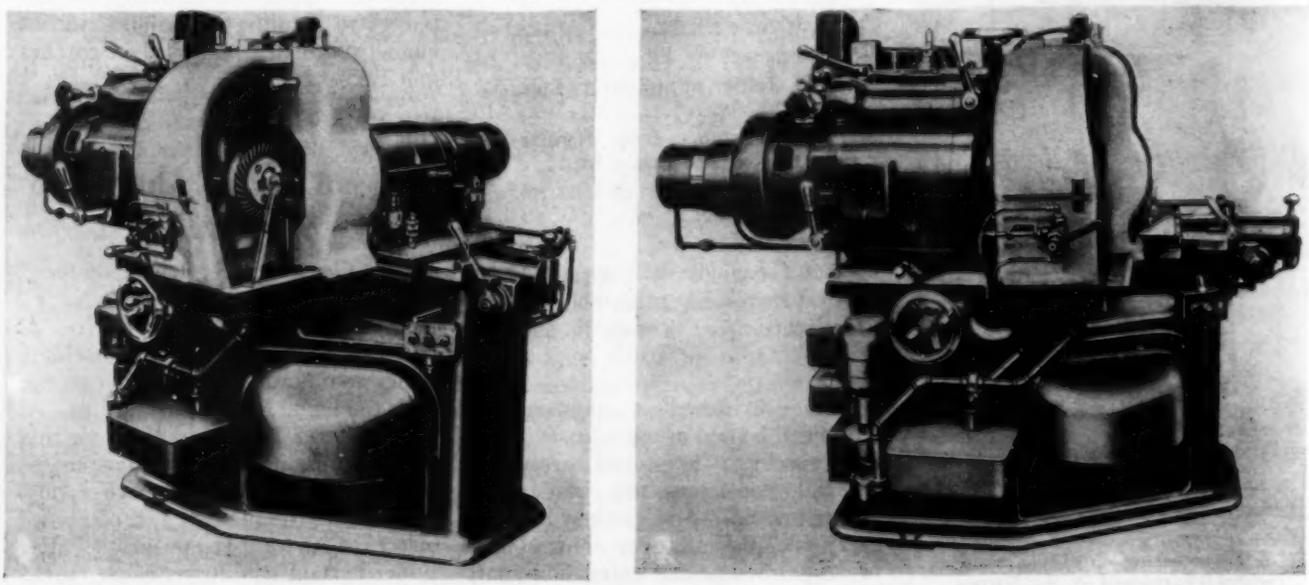
The pinion head is moved into and out of operating position hydraulically, controlled by two hand levers. The first lever chucks the pinion and moves the head in until the pinion is within $\frac{3}{4}$ in. from the gear. The second lever operates a special jogging valve that moves the pinion into mesh, the correct position being determined by a positive stop. Chucking of the gear is also hydraulically controlled.

When the gears are in position, the lapping guard is swung up, closing the electrical circuit so the machine can be started by means of a conveniently located starting button. If the guards are opened while the machine is running, it will stop. This is a safety feature.

An automatic control mechanism is provided for timing the lapping operation and also functions to shift the lapping cams. It reverses the direction of rotation of the gears after they have been run in one direction for a predetermined length of time, and stops the gears after they have been run in the reverse direction the same length of time. A different movement is required for each side of the teeth. This involves a mechanism that will lift the cam roller, shift the cam, reverse the drive motor, and finally, when the second side is lapped, stop the machine.

The relative time of lapping may be adjusted at from 30 seconds to 33 minutes per side, and the total time may be varied. After the lapping operation is complete, the opening of the splash guard automatically moves the pinion head away from the gear head far enough so that the pinion may be removed without interfering with the gear. At the same time, the chuck holding the pinion releases. The gear is dechucked by movement of the hand lever, which also strips it from the arbor.

The base of this 18-in. lapping machine is a heavy box section reinforced with ribbing. The bearing ways on the frame are of liberal width, and narrow guides give close alignment. The driven head is mounted on a column adjustable horizontally on the frame. This driven head has a vertical adjustment also to permit lapping hypoids. The spindles on which the gears are mounted are bored 2.292 in. at the large end with $\frac{1}{2}$ in. taper per ft. for 7 in. They are mounted on matched ball bearings, and seals of labyrinth construction are provided to protect the bearings from foreign matter. Noses of the spindles are hardened and the taper holes are ground with the spindles in place in their own bearings, insuring concentricity of the spindle. An adjustable backlash brake, operating on the gear spindle,



Gleason 18-in. Hydraulically Operated Testing and Lapping Machine for any size gear commonly employed for the final drive of automobiles, omnibuses, tractors, and trucks

is provided to maintain an even load during the lapping operation.

The lapping compound is circulated by a pump unit. Guards to prevent the splashing or throwing of the lapping compound are split to facilitate mounting and removal of large gears. A 5-hp., 1,500 or 1,800 r.p.m. motor is employed for the main drive and is set in the base of the machine. Two small motors, one for the oscillating motion and the other for the lapping compound pump, are furnished as standard equipment. Power for operating the hydraulic features is provided by a central hydraulic unit, having a capacity of 2½ gal. of oil per min. at a pressure of 150 lb. per sq.in. This unit is not furnished.

Kearney & Trecker Positive-Lock Face-Milling Cutters

A line of positive-lock face milling cutters of the inserted-blade type has been developed by the Kearney & Trecker Corporation, Milwaukee, Wis., for production and general-purpose milling. They are not intended for heavy hogging purposes, but are primarily for medium roughing and finishing operations. The blades are so spaced as to make the cutter suitable for milling of surfaces made up of thin, narrow sections. Fig. 1 shows a group of these cutters ranging in size from 5 to 16 in. in diameter.

Two styles of these cutters are offered, one equipped with high-speed steel blades, and the other with Stellite blades. The only difference is in the angular mountings of the blades. Spacing of the blades for both styles is such that ample chip clearance is provided at various speeds, feeds, or depths of cut. The cutters can also be equipped with blades tipped with cemented tungsten-carbide.

The method of mounting the blades is illustrated in Fig. 2. A positive lock is attained by means of a hardened and ground tapered wedge. This feature is accomplished by grinding the front side of the blade to a taper that corresponds to the contacting face of the tapered wedge. With a screw in place there is no danger of having the blade lift out of place.

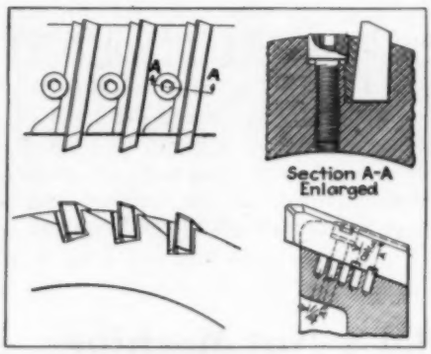


Fig. 2—Method of mounting blades in Kearney & Trecker Positive-Lock Face-Milling Cutters. ⅛-in. adjustments are possible

End slippage of blades is eliminated by a set of small pins, one of which is mounted in each slot of the cutter body and fits into one of the grooves at the bottom edge of the blade. The spacings of the five holes in each of the slots in the body are at ¼-in. centers, and the two slots in the blade are spaced ⅜ in. apart, so that the blades can be adjusted outward in increments of ⅛ in. as the blades become worn.

Cutter bodies are made from chrome-nickel-steel forgings, which are normalized after rough-machining. After being finish-machined, the body is case-hardened and finish-ground on the top and bottom faces and the mounting fits. The bodies are made cone-shaped so that the blades are positioned at an angle to the axis of the body, which allows a uniform outside diameter to be maintained as the blades become worn. Uniformity is attained by adjusting the blades outward, and then grinding their bottom and peripheral faces to suit.

The locating surface from which the body is attached to the machine spindle is counterbored on all cutters 9 in. in diameter, and larger, to provide a means of locating the cutter over the outside diameter of the spindle nose, instead of location by a centering plug. This design prevents the locating surface from becoming marred while being installed.

High-speed steel blades for these cutters have 0.025 in. of metal removed after hardening and before assembly to the cutter body to offset decarbonizing during heat-treatment. All of these blades are made interchangeable and will fit any size of cutter body. This feature eliminates the necessity of carrying several sizes of blades in stock for bodies of different diameters. But, since the bodies for Stellite and high-speed steel differ slightly, the two types of blades cannot be interchanged, except with their respective bodies.

K & T positive-lock, inserted-blade cutters are made in 14 sizes, ranging from 5 to 24 in. in diameter. The

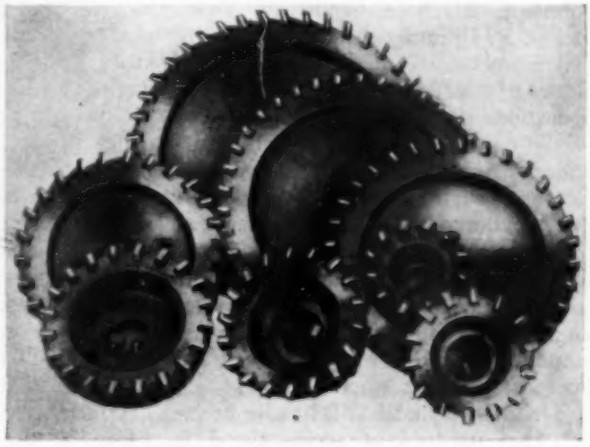


Fig. 1—Representative Kearney & Trecker Positive-Lock Face-Milling Cutters ranging from 5 to 16 in. in diameter

5-, 6- and 7-in. cutters are for use with style C, shell end mill arbors; the 8 in. cutter is arranged to bolt on the spindle and can be centered by a centering plug, whereas the larger sizes are centered over the diameter of the spindle nose.

General Electric Grease for Motors

A grease for ball and roller bearing motors has been developed by the General Electric Company, Schenectady, N. Y. It is used in the G.E. factories for the initial lubrication of all-general purpose motors using these types of bearings. It has been successfully employed for ball bearing application with speeds as high as 25,000 r.p.m. and temperature ex-

posures from —25 to 250 deg. F. However, its use is recommended only for motor bearings where the motors were originally grease lubricated.

The grease contains no free acid or water, and will not turn rancid. There is very little tendency to gum-cake or separate. It has unusual film strength, enabling it to withstand severe thrusts and heavy bearing loads. It is supplied in two-ounce tubes and one-pound cans. The tube is calibrated into one-half ounces and the cover of the can holds two ounces. This assists in measuring the amounts of grease recommended for the various bearings without weighing the lubricant.

"Ekonomatic" Model 1 Nut Machine

A small-size nut machine, designed primarily for the manufacture of nuts ranging from ¼ to ½ in., has been placed on the market by the Potter & Johnston Machine Company, Pawtucket, R. I., under the trade name of "Ekonomatic." This machine is capable of performing a number of operations from the bar. The base of the machine is 3½ ft. long by 2 ft. wide. Aside from allowance for clearance of the bars extending from the spindle end of the machine, these dimensions represent the extreme overall, thereby allowing a battery of such machines to be set up on an angle, similar to the standard practice employed in the case of all other tools operating on bar stock.

The main spindle will handle hexagon bars up to ⅞ in. across the flats for ½ in. hexagon nuts and 1 in. round stock. The 2-hp. motor installed in the base is ample for all requirements. By the employment of a cut-off tool $\frac{1}{16}$ in. in width, and a stock feeding mechanism that carries the bar completely through the spindle to the gripping surface of the collet, minimum wastage is achieved. Since the "Ekonomatic" Model 1 is of the single-spindle type without indexing mechanism, soluble-oil coolants can be employed without detrimental action to any of the operating parts.

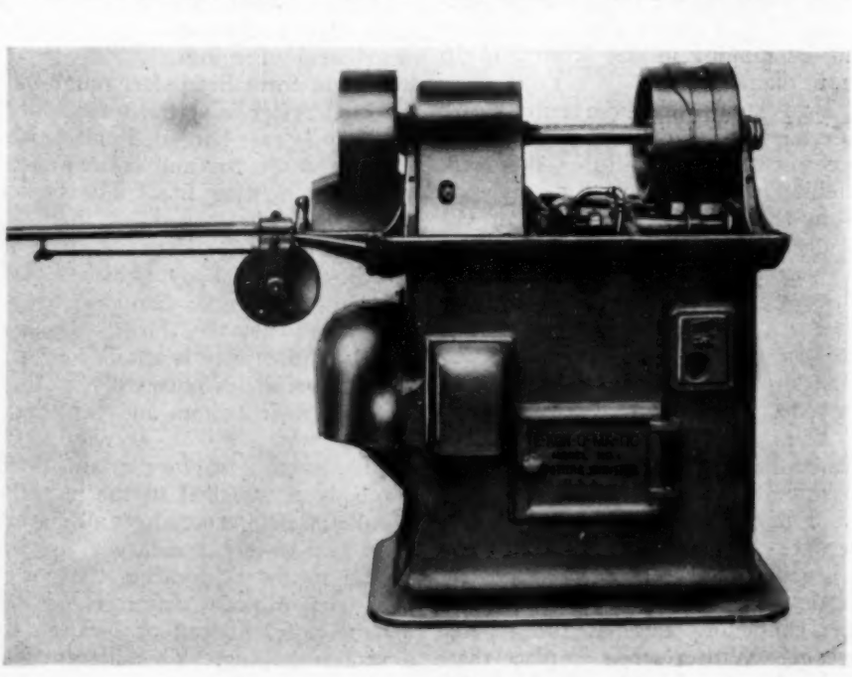
Simplicity of construction; the use of anti-friction spindle bearing mountings; heat-treated steel gearing; and easy cam angles tend to eliminate the cause of breakage, excessive wear, and consequent maintenance expense. The bar is fed to the working position by a mechanism employing a long heavy coil spring contained within the feeding cable pulley. The conventional form of feed stop is not used, thereby eliminating the time consumed in bringing this lever in and out of position. Operation of the center tool bar and double-action swing arm, which carries the cutting off and forming tools, are closely timed to synchronize their feeding movements. Mounted on the camshaft, directly over the spindle, is a swing arm that carries cams for engaging and disengaging the collet at the proper point in the cycle. The collet is of the draw-back type, connected to the rear of the spindle by means of a tube on the end of which is mounted a collar. Pull back of the collet is accomplished through the use of fingers. Instead of the conventional design of sliding spool, the fingers are compressed by an external wedge collar for operating the draw back, thereby eliminating the detrimental effects of centrifugal force in the disengagement of the collet.

The casting supporting the spindle and feed mechanisms is designed to eliminate destructive vibration on the tools. This increases the run between grinds and makes possible an output determined only by the standards of quality desired.

Only three cams are required for the operation of the "Ekonomatic": one for the feed and return of the center tool bar; one for the operation of the double action swing arm; and the simple permanent cam for the collet operation. For the greater portion of work within the range of the "Ekonomatic," the standard cams supplied for the center bar and swing arm movements will be found satisfactory. If it should be necessary to change the contour of the cams for the performance of special operations, the mounting of the drum will be found convenient.

Required spindle speeds are obtained by changing the motor sprocket. An adjustable idler is provided to compensate for the variation in chain length.

Within the base, accessible through the main door, is a strainer receptacle, into which pass the finished parts as they are cut off at the spindle nose. Below, is the main supply of coolant, carried to the spindle nose by means of a chain-driven gear pump. Provision is made for the use of 9 gal. of soluble oil compound, thereby assuring the maintenance of temperature within practical limits.



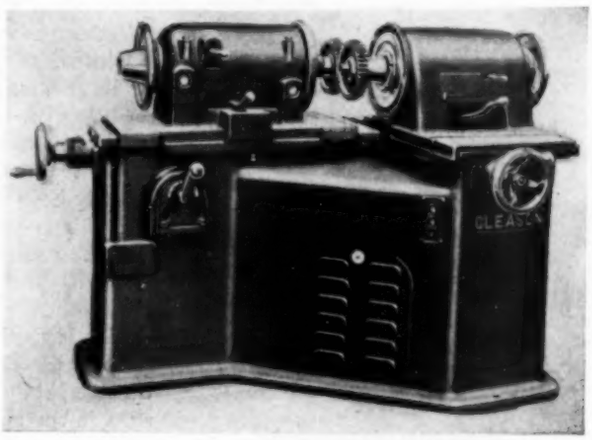
From ¼- to ½-in. nuts can be produced on the Ekonomatic Model 1 Nut Machine

Gleason Spur Gear Testing Machine

Running qualities of spur gears up to 14½ in. pitch diameter can be tested on the machine illustrated below, which has been placed on the market by the Gleason Works, 1000 University Ave., Rochester, N. Y. The machine can be used for testing cluster gears as well as gears with an integral shank, also helical, herringbone, and internal spur gears. The gears are tested by running them together in pairs or by running several gears successively with a given test pinion. They can be tested with or without load as desired, the load being applied manually by a brake operating on the driven spindle.

A one-piece frame is employed for this machine, and the heads are adjustable horizontally on the frame by means of a handwheel and leadscrew graduated to show 0.001 in. These heads are mounted so the spindles are in exactly the same plane and parallel. Both heads are locked to the frame at front and rear by separate clamps. The spindles are mounted in the heads on matched ball bearings, the noses are heat-treated, and the taper bores are ground with the spindles in place.

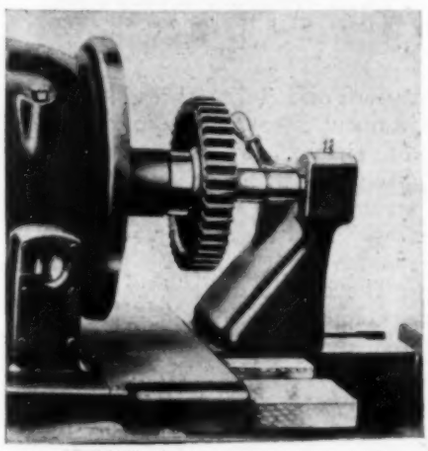
An outboard support is furnished with each machine for use with gears having a long integral shank. This support bolts directly to the frame, or an overarm type of support can be furnished. A 5-hp. motor drives the spindle. Equipment furnished includes all gages and tools necessary for the operation of the machine. Arbors are not standard equipment.



Gleason Spur Gear Testing Machine for the running qualities of spur gears up to 14½ in. pitch diameter

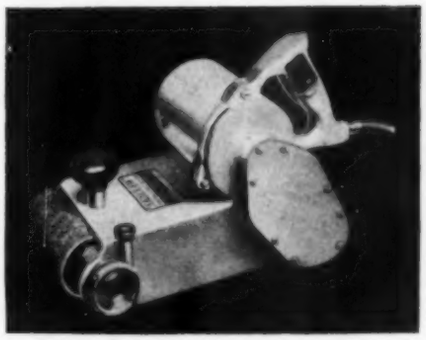
If it is desired to run gears together with a mild abrasive to remove slight roughness occurring in heat-treatment, a pump, sump, and motor can be furnished as extra equipment.

Specifications	Min.	Max.
Distance between noses of spindle on brake and drive heads, in.	3	18
Distance from center of brake head spindle to center of drive head spindle, in.	3	10
When way guards are removed, in.	0	10
Distance between adjustable tail center and nose of brake head spindle, in.	0	14½
Diameter of gear that can be tested, in.	0	14½
Floor space, in.	61½ by 77	
Net weight, lb.	4,000	



Skilsaw Electric Belt Sander

Wood or metal can be surfaced with the electric belt-type sanding machine announced by Skilsaw, Inc., 3814 Ravenswood Ave., Chicago, Ill.



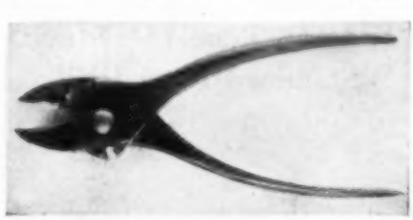
Because of the traveling belt employed, surfacing without ripples is secured and extra smooth finish is attained through the use of a flexible pad.

Changing belts can be effected in a few seconds by the adjustment of the front roller on an eccentric shaft. Tension is controlled on the belt by a handwheel on the side of the machine. A convenient thumbscrew adjustment provides alignment of the belt on the rollers.

No supporting rollers or wheels are used to maintain a vertical position on the work. For accuracy, strength and lightness, the frame is made of die-cast aluminum. The universal motor is air-cooled by a centrifugal fan and operates from a light socket. Helical gears afford silent operation and are made of heat-treated nickel steel. Ball bearings are employed throughout. The belt size is 4½ in. x 26⅝ in. long with a free speed of 1,700 ft. per minute. Pulleys are 2½ in. in diameter. The over-all size of the sander is 7 x 14 x 9 in. high, making for convenience in use. The net weight of the machine is 18 lb.

Leo 7½-Inch Pliers

A single size of pliers, 7½ in., is being manufactured by The Leo Manufacturing Company, Danville, Ill. These pliers are nickel plated

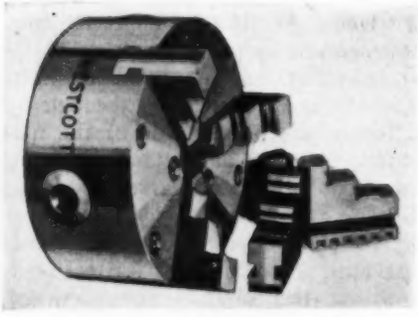


and have a claw on the side to pull staples and cotter keys. They are of heat-treated alloy steel, having manganese and silicon contents.

Westcott Bevel-Geared Scroll Universal Chucks

One-piece bodies are employed for the bevel-geared scroll universal chucks manufactured by the Westcott Chuck Company, Oneida, N. Y. Steel forgings are used exclusively in the smaller sizes, 3, 4, 5 and 6 in., and larger sizes are available with semi-steel or electric steel bodies. Furthermore, special steels are used in the jaws, scrolls, and pinions.

These chucks have been built to be extremely accurate and at the same time possess an excess of strength to meet the requirements of modern production methods and the use of tungsten-carbide cutting tools. These chucks will be made in the following sizes: 3, 4, 5, 6, 7½, 9, 10½, 12, 15, 18, 21 and 24 in. The last three sizes will be extra-heavy in design. Sizes above 24 in. will be made to order. At the present time only the 4 in. size is ready for delivery.

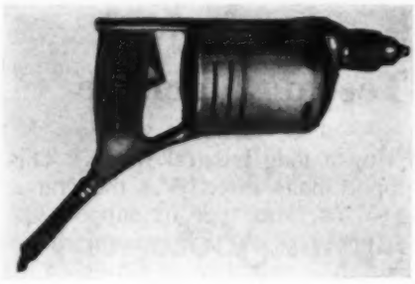


Westcott Bevel-Geared Scroll Universal Chuck with two sets of jaws

These chucks will be furnished with two sets of jaws; one set for either outside or inside chucking at the customer's option or two-piece reversible jaws.

"Ideal" Type LO ¼-Inch Standard Duty Drill

A ¼-inch standard duty drill, known as the "Ideal" type LO, has been added to the line manufactured by the Schauer Machine Company, Cincinnati, Ohio. This tool measures only 10½ in. over-all and weighs 5½ lb. It embodies a special universal motor having the armature shaft and the chuck shaft mounted on

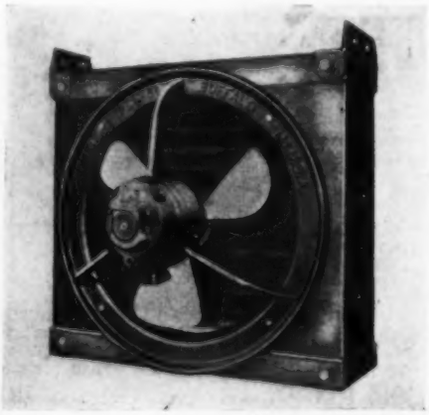


New Departure sealed-type ball bearings. The method of mounting these bearings makes for a much shorter drill, which is of advantage in close corner work.

A removable plate on the housing permits ready inspection and adjustment of the commutator and brushes, while a removable plate on the handle permits inspection of the switch connections. The cable for the switch is protected by a special clamp and spring, which eliminates strain on the terminals. Regular equipment includes a three-jaw key chuck.

Buffalo Model B "Breezo-Fin" Unit Heater

Welded stampings make up the casing of the model "B", suspended-type unit heater developed by the Buffalo Forge Company, Buffalo, N. Y. Simple clip hangers are furnished as standard equipment and can easily be attached to any two of the four corners, providing support for either platform, side bracket, or top suspension. The fan is claimed to be unusually quiet, and the bracket is die-stamped and welded. Discharge louvers are separately adjustable to direct the air where desired. An "Aerofin" heater element is standard, and is suitable for any steam pressure from 2 to 250 lb. per sq.in.

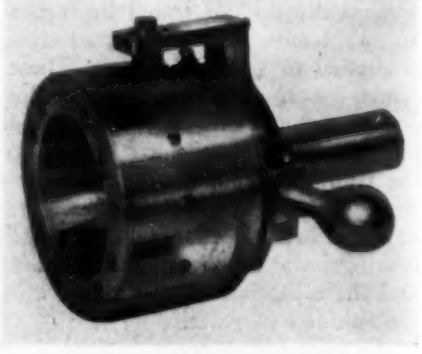


The model B "Breezo-Fin" is manufactured in eight sizes. Fully enclosed motors are standard equipment. At a slight additional cost, variable-speed "capacitor" type motors are available in 110- or 220-volt, single-phase types, permitting three operating speeds.

"H & G" No. 10 Style D Light-Duty Diehead for Turret Lathes

Cutting relatively fine pitch threads on large diameters is the feature of the No. 10, style D, light-duty diehead announced by the Eastern Machine Screw Corporation, Truman & Barclay Sts., New Haven, Conn. The diehead is available for diameters from 2 to 3 in. with pitches not coarser than 10 and for lengths not over 2¼ in.

The No. 10 head has six chasers in a set. The chaser cams are supported by the body and engage diagonal slots in the chasers to open them in a positive manner without individual springs. The diehead has a detachable shank, which can be supplied in



"H & G" No. 10, Style D, Light-Duty Diehead for turret lathes. It is especially designed for cutting fine pitch threads on large diameters

various diameters. Thread length adjustment is carried on an arm from the shank. Adjustment for pitch diameter is by means of a micrometer screw on the front face. Both of these adjustments can be made rapidly.

The No. 10 diehead weighs 21 lb. as compared with 40 lb. for a regular 3-in. diehead. The outside diameter is 5¾ in., and the over-all length, not including the shank, is 4 7/16 in. Chasers are removed radially by de-

pressing a stop plunger. A friction device holds the chasers in place and adds to the ease of installing them.

The diehead has ample float and this feature together with its lightness makes it suitable for threading the softer metals, where the threads are short and of fine pitch.

"High Speed" Model R-53 Pedestal-Type Sensitive Drilling Machine

A pedestal mounting is now available for the Model R-53, high-speed, sensitive drilling machine manufactured by The High Speed Hammer Company, Inc., Rochester, N. Y. Previously this machine has been available only in a bench type. Other special features include a three-speed pulley combination designed for spindle speeds of 1,500, 3,000 and 6,000 r.p.m., and the treadle control.

Features common to both the pedestal and bench types are a hardened and ground spindle carried by two ball thrust bearings, maximum spindle travel of 2¼ in., and a quickly detachable guard for the front pulley and upper part of the spindle. The machine will drill to center of a 6 in. circle. The working surface is 4x6 in. Standard equipment includes a 110- or 220-volt, single-phase, 25-, 50- or 60-cycle motor, or a 110- or 220-volt, d.c. motor. The chuck will take up to ¼ in. drills.

Smith Small Speed Reducers

Small reduction gears for use with ⅛-hp. motors have been placed on the market by Winfield H. Smith, Inc., Springville, N. Y., in the Nos. 2B and 3B types. These models employ anti-friction bearings throughout. Specially designed ball bearings eliminate the need for stuffing boxes.

The model 2B can be furnished with ratios of 48 to 1 and 30 to 1, and the No. 3B in ratios of 20 to 1, 10 to 1, and 5 to 1.

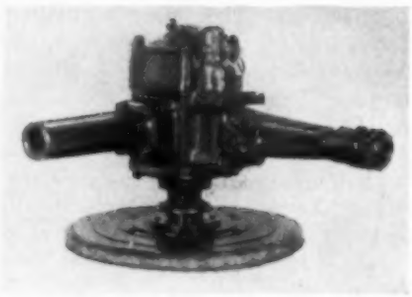
Another model is the No. 2DB,

Smith No. 2B Reduction Gear for use with ⅛-hp. motors

which can be furnished with ratios of 400 to 1, 200 to 1, and 100 to 1. It has a double worm gear drive, capable of transmitting a torque of 150 in. lb. Radial thrust ball bearings are furnished on the high-speed shaft, ball thrust bearings on the intermediate shaft, and plain bearings on the slow-speed shaft.

"Thor" No. 260S Rotary Pneumatic Sander

A center-spindle-type sander equipped with two handles has been developed by the Independent Pneumatic Tool Company, 600 W. Jackson Blvd., Chicago. This "Thor" sander, known as the No. 260S, is balanced and operates without vibration. Among its numerous uses in cleaning and sanding are automobile body plant operations, for dressing welded seams and removing high spots prior to the sanding operation, and in general foundry work.



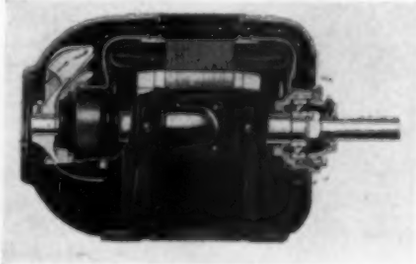
"Thor" No. 260S Rotary Pneumatic Sander

One of the construction features of this sander is the governor. When the sander is at peak load, the governor automatically opens the throttle and admits as much air as necessary to perform the job. When the motor is running idle, the governor automatically decreases the air consumption, thus saving wear on the moving parts. The speed of the Thor 260S sander is 4,500 r.p.m. Weight, less wheel or disk, is 10 lb. The over-all length is 8 in., and the spindle thread is ⅝ in. x 11 threads per in. U.S.S.

General Electric Type K Totally-Inclosed Fan-Cooled Motors

A line of dust-tight, totally inclosed, fan-cooled induction motors has been developed by the General Electric Company, Schnectady, N. Y. These motors are equipped with ball bearings, in convenient "cartridge" housings. This line provides a totally inclosed motor of the same mounting dimensions, rating for rating, as the standard open-type, General Electric, horizontal, general-purpose motor, from ¾ to 50 hp. in popular speeds.

Size and weight are minimized in

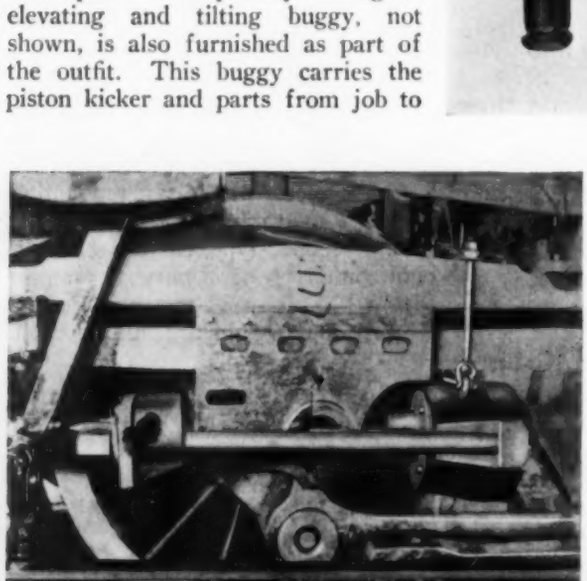


these motors. The single ventilating fan is located outside the motor enclosure on a short shaft extension opposite from the pulley end. A double frame is used, providing air passages for the ventilating air. The fan is housed in a cast-iron enclosure. Air is blown through the ventilation passages and out at the pulley end.

Any disassembly or reassembly of the motor is facilitated by the simplified mechanical construction. Cartridge type ball bearing housings are a further aid in this respect and permit the removal of the rotor without exposing the bearings to dust or dirt. The motor is endorsed by the Underwriters' Laboratories for hazardous dust conditions specified as Class 2 in the National Electric Code.

"Watson-Stillman-Hollowell" Piston Kicker

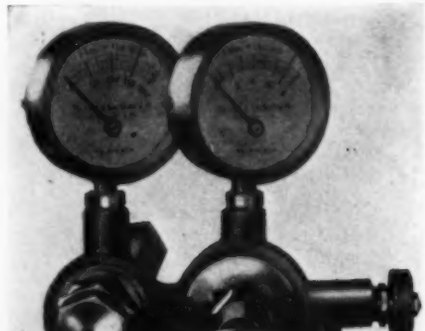
For removing piston rods from crossheads, the Watson Stillman Company, 75 West St., New York, N. Y., has brought out the Watson-Stillman-Hollowell piston kicker. The machine is illustrated as attached to the locomotive frame ready to remove the piston. Hydraulic pressure is supplied by a hand pump and separates the piston rod from the crosshead without marring the fit or cracking the crosshead, since the entire crosshead is used for the purchase. A pressure of 125 tons is developed. A specially designed elevating and tilting buggy, not shown, is also furnished as part of the outfit. This buggy carries the piston kicker and parts from job to job and simplifies setting up equipment. Twenty minutes is the average time required to set up, remove, and tear down the piston kicker.



"Messer" High-and Low-Pressure Welding Gas Regulators

High- and low-pressure "Messer" regulators for oxygen and acetylene tanks have been introduced into the United States by Jos. C. Paulus & Company, 2507 Potter St., Philadelphia, Pa. These regulators give a free flow of gas at uniform pressure. Forged bronze parts insure ample strength and freedom from defects.

High-pressure oxygen regulators are available for cutting from 4 to 24 in., and have a contents gage showing from 0 to 3000 lb. The pressure gage registers from 0 to 450 lb. Low-pressure oxygen regulators are available for use on all welding or cutting from $\frac{1}{8}$ up to 4 in., and also have contents gages showing from 0 to 3000 lb. The pressure gage of this unit is for 0 to 120 lb. per sq.in. Acetylene regulators are available for all welding work with oxy - acetylene flames and for cutting from $\frac{1}{8}$ up to 12 in. The contents gage is marked from 0 to 450 lb., and the pressure gage from 0 to 45 lb.



Cutting from 12 to 24 in. can be controlled by high-pressure hydrogen regulators having contents gages registering from 0 to 3000 lb., and pressure gages from 0 to 450 lb. The low-pressure models are for use on all welding or cutting work with the oxy-hydrogen flame and have gages calibrated from 0 to 45 lb. None of these regulators weighs more than $5\frac{1}{2}$ lb.

Rothweiler Hand Pump for Steel Drums

Pumping cutting compounds, machine oil, and lard oil is one of the uses for the "Useful" pump developed by Rothweiler & Company, 2430 First Ave., South, Seattle, Wash. Other uses in metal-working establishments include pumping of paint, lacquers, thinners in paint shops. The pump will fit all steel drums. It fits in the small opening and takes the place of a faucet. The base of the pump has a $1\frac{1}{4}$-in. pipe thread, which can be screwed on floor flanges, underground tanks, or in any place that has a standard pipe thread. Seven gal. of water per minute can be pumped without exertion. Discharge outlet has a $\frac{1}{2}$-in. standard pipe thread, and the suction inlet, $\frac{3}{4}$ in.

"Steelgrip" Universal Gear and Wheel Puller

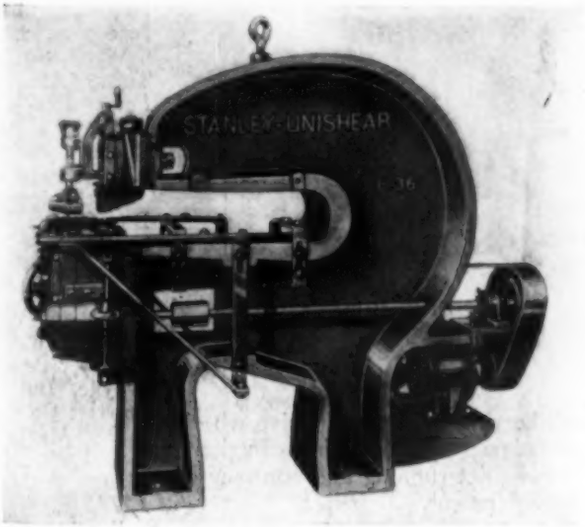
Large or small gears, wheels or pulleys, can be removed from shafts by means of the "Steelgrip" universal gear and wheel puller announced by Armstrong-Bray & Company, Chicago, Ill. The machine is easy to operate and will work in awkward places. "Steelgrip" pullers are equipped with three chains each 3 ft. long, although longer lengths can be

furnished. These chains enable the workman to pull gears, regardless of the distance they are in from the end of the shaft. A chrome-nickel steel screw is employed with a hardened point. The pulling power of the "Steelgrip" puller is approximately 4 tons. A No. 4 heavy-duty "Steelgrip" puller has been added to the line and is used on very large and heavy work. It is equipped with three chains 5 ft. in length and has a pulling power well over 12 tons.

Model B "Stanley-Unishear"

Straight lines, curves, designs, and inside contours on heavy flat stock up to ¼ in. can be cut on the Type B "Stanley-Unishear" announced by The Stanley Electric Tool Company, New Britain, Conn. All of these operations can be performed at speeds up to 10 ft. per min. and complete circles can be cut to a minimum radius of 6 in. on ¼ in. material and less than 3 in. radius on thin material.

The frame is provided with a throat 36 or 50 in. and the upper head unit carries the stationary blade. An oscillating rocker is carried in the lower head unit with its blade and driving mechanism. While shearing, the sheet is supported by a table and roller. These can be adjusted to take care of sheets of different gages by means of the handwheel. To relieve the operator of strain, a stabilizer fitted with a piece of brake lining is attached to the upper head unit. This sheet stabilizer is also adjustable up and down for various sheet thicknesses, but it can be turned up out of the way when trimming the edges of the flanged sheets.



Type B "Stanley-Unishear," which has either a 36 or 50 in. throat and will cut up to ¼ in. boiler plate

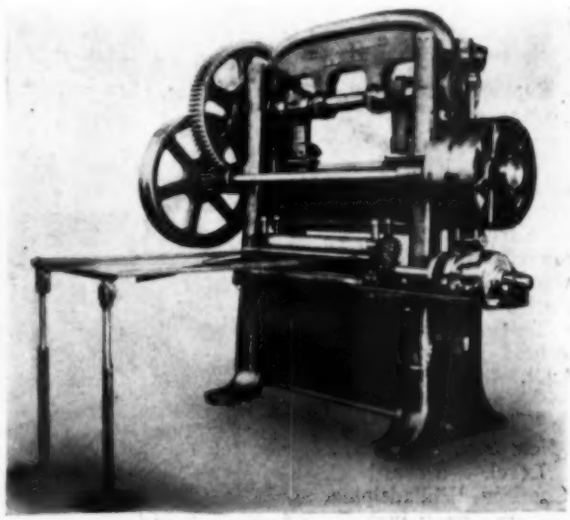
Zeh & Hahnemann Double-Crank Press With Stagger-Roll Feed

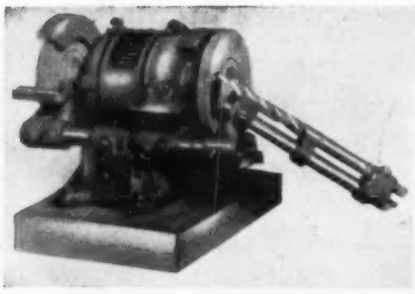
For blanking small parts, such as transformer laminations, in large quantities, the Zeh & Hahnemann Co., Newark, N. J., has brought out a double-crank power press with automatic roll feed, which permits the cutting up of the sheet without preliminary slitting. This is claimed to not only save time but also to reduce material waste to a minimum.

The machine, which has an unusually high output, produces 250 blanks per minute. Five dies are used and the press makes 50 strokes per minute. The feed works on the pilgrim step principle: Forward, punch; right, punch; forward, punch, left, punch, and repeat above. The press weighs 10,000 lb. It provides 50 tons pressure and has 48 in. between the uprights. Sheet 36 in. wide x 8 ft. long may be fabricated.

Wappat Drill Grinding Attachment

An inexpensive drill grinding attachment for use with its 6-in. bench grinder has been brought out by Wappat, Incorporated, Electric Tool Division of Simonds Saw & Steel Co., 7522-26 Meade St., Pittsburgh, Pa. This device is particularly suitable for small shops where investigations have shown that drilling costs are from 50 to 200 per cent higher than they would be if drills were sharpened correctly. The device will grind all 2-lip drills from the smallest up to 1⅜ in. in diameter. Adjustments for varying the diameter and the clearance can be made easily and accurately. The grinder is mounted on





Wappat Drill Grinding Attachment on Wappat 6-Inch Bench Grinder

ball bearings and the abrasive wheels are balanced. Rubber feet contribute to the quiet running and accuracy of the equipment.

PATENTS

October 7, 1930

Metal-Working Machinery

Mold Stand. Arthur T. Bateman and Frank E. Storey, Detroit, Mich., assigned to Bohn Aluminum & Brass Corporation. *Patents 1,777,277 and 1,777,289.*

Lathe Bed. Francis B. Cockburn and Herman J. Breitenbach, Cincinnati, Ohio, assigned to The Lodge & Shipley Machine Tool Co. *Patent 1,777,603.*

Machine for Grinding Bodies of Revolution. Carl Gustav Ekholm and Bengt Daniel Ossian Westerlund, Lidkeping, Sweden. *Patent 1,777,607.*

Mechanism for Crimping Leader Pipe. August D. Kumpf, Philadelphia, Pa., assigned to Berger Brothers Co. *Patent 1,777,728.*

Machine for Making Clock Pinions. Penrose R. Hoopes, Hartford, Conn., assigned to William L. Gilbert Clock Co. *Patent 1,777,849.*

Automatic Wheel Feed. Amos P. Steiner, Waynesboro, Pa., assigned to Landis Tool Co. *Patent 1,777,938.*

Tools and Attachments

Expansible Mandrel. Joseph Kuffner, Milwaukee, Wis. *Patent 1,777,316.*

Dies and Method for Closing Pressed-Metal-Pipe Fittings. Hjalmar G. Carlson, Worcester, Mass., assigned to Rockwood Sprinkler Co. *Patent 1,777,351.*

Thread-Cutting Die. Albert J. Prance, Detroit, Mich., assigned to Murchey Machine & Tool Co., Detroit, Mich. *Patent 1,777,380.*

Level. Richard C. Charlton, Philadelphia, Pa., assigned to Henry Disston & Sons, Incorporated. *Patent 1,777,429.*

Wrist-Pin Puller. Harry H. Franks, Tulsa, Okla., assigned to Tidal Oil Co. *Patent 1,777,432.*

Welder's Helmet. William Shirmer, Phoenix, Ariz., assigned to William L. Allison. *Patent 1,777,454.*

Mechanism for Casting Annealing Box Covers. Harry E. Sheldon, Pittsburgh, Pa. *Patent 1,777,506.*

Annealing Box. Matthew P. Wilson, Canonsburg, Pa. *Patent 1,777,595.*

Tool and Work Support. Leon Hommel, Oakland, Calif. *Patent 1,777,616.*

Center Punch. Henry C. Rehm, Fort Wayne, Ind., assigned to The L. S. Starrett Co. *Patent 1,777,653.*

Die Mechanism. John W. Shera, Oak Park, Ill., assigned to American Flange & Manufacturing Co. *Patent 1,777,772.*

Bearing Scraper. Joseph C. Barbee, Des Moines, Iowa. *Patent 1,777,780.*

Tool Clutch. Joshua C. Edgecumbe, Westfield, N. J. *Patent 1,777,829.*

Automatic Hammer. Roy J. Champayne, Rockford, Ill. *Patent 1,777,875.*

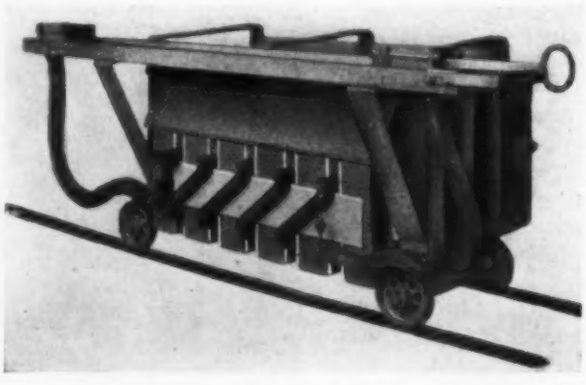
Extractor. Julius O. Roberts, Bentonville, Ark. *Patent 1,777,936.*

Chuck. Adolph L. De Leeuw, Plainfield, N. J., assigned to The Goss & De Leeuw Machine Co. *Patent 1,777,962.*

Apparatus for Feeding, Positioning, and Discharging Metal Blanks. Edward E. Johnson, St. Paul, Minn. *Patent 1,778,005.*

Berwick 6-Ft. Billet Heater

Bars 1 in. in diameter by 6 ft. long can be heated to 1,900 deg. F. in one minute on the latest Berwick billet heater announced by the American Car and Foundry Company, 30 Church St., New York, N. Y. Such bars are of use for hand feed bolt and rivet machines. Other uses of the machine are for heating up long paper knife stock (in a vertical arrangement of the machine), large bars for ball bearings, and heating razor blade stock. From 10 to 15 kw. are required per 100 lb. of material. About 72 volts are employed at the terminals of the machine.



Such bar heaters can be built for any length stock from 4 ft. up to 10 ft. The machine illustrated is built up of standard heater units, the bar being placed between the two terminals at the top of the machine. These terminal blocks are adjustable along the channel to different lengths of stock. The handle shown at the right is employed for pushing the right-hand terminal to contact with the bar and a small coil spring in the mechanism permits it to spring back sufficiently when the bar expands during heating. This prevents buckling of the bar.

TRADE PUBLICATIONS

BUDGETING MANUFACTURING OPERATIONS. The Metropolitan Life Insurance Co., Policyholders Service Bureau, 1 Madison Ave., New York, N. Y., has published a timely report entitled "Budgeting Manufacturing Operations" presenting the budgeting practices of more than 80 representative manufacturing concerns. Aspects of the problem studied are production schedules, material, labor and manufacturing expense budgets; methods of control for plant and equipment expenditures; comparison of actual and budgeted accomplishment, and incentive systems for securing the latter.

COMPRESSORS, TWO-STAGE. The Pennsylvania Pump & Compressor Co., Easton, Pa., now has available bulletin No. 153 on "Two-Stage Air Compressors of the Straight Line & Tandem Type." The constructional features of these compressors are thoroughly described, and a table of sizes appended.

DIEHEADS. The Landis Machine Co., Inc., Waynesboro, Pa., has available bulletin No. H-76 on "Lanco Heads for Automatic, Semi-Automatic and Hand-Operated Threading Machines." A complete description, specifications, and diagrams, of clearances are given.

TRUCKS, FLOOR. The Lewis-Shepard Co., Watertown Station, Boston, Mass., has issued a catalog "Lewis-Shepard Floor Trucks," covering its complete line of both standard and special types, which are arc-welded.

WELDING ROD. The Fusion Welding Corporation, 10257 Torrence Ave., Chicago, Ill., has issued a circular on "Weldite" Green Surfaced Welding Rods, which are of mild steel and coated with flux.

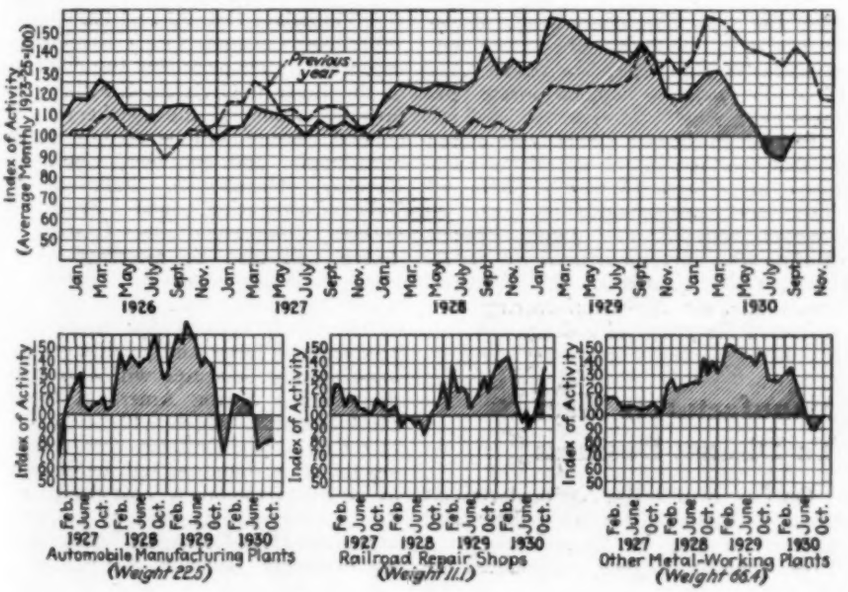
NEWS OF THE WEEK

September Metal-Working Operations Show Unusually Decided Upturn

SEPTEMBER operations in the country's metal-working plants show a sharp upturn from those of August. Reports received on the consumption of electrical energy for power purposes indicate that the downward trend which started in March and continued until July and which showed signs of a definite arrest in August after reaching the lowest point since October, 1924, is now ended and that the indices are turning sharply upward. For example, the rate of operation in metal-working plants in general during September was 100.4 per cent, as compared with 88 per cent for August and 90.4 for July. This figure is raised to 101.0 when corrected for seasonal variations, as compared with 93.2 per cent for August and 95.1 for July.

The automobile industry, including the manufacture of parts and accessories, reported an index of activity of 82.6, as compared with 78.1 for August and 75.3 for July. July's figure was the lowest recorded since January, 1925, being 27.5 per cent less than that of June and 48.4 per cent less than that of July of last year. In the ferrous and non-ferrous metal-working plants outside of automobile and railroad repair shops, the reported figure was 100.4, as compared with 89.4 for August and 95.1 for July. The August figure was the lowest recorded since June, 1925.

Activity in railroad repair shops shows a decided increase during August, going to 100.7 from 92.3 in July. This increase is, however, dwarfed by the figure of 136.1 for September. This is all the more striking when it is considered that these plants were operating in July at the lowest point since the barometer was established at the opening of 1923. Since these are preliminary figures, however, there may be some change later. Adjusted for seasonal variations, the preliminary figure for September on the railroad shops was 140.7, that of the automobile group was 79.8 and of the other metal-working plants 101.5, all decided upturns from the figures of the preceding month.



Drop Forgers Meet at Briarcliff

With good representative attendance and an excellent program, the American Drop Forging Institute held its fall meeting at Briarcliff Lodge, Briarcliff Manor, N. Y., Oct. 9, 10, and 11. C. H. Smith, president, in his opening address, stressed the opportunities afforded by reviving business.

The following addresses and papers were presented, all well received: "Fuel Oil and Furnaces," R. C. Hopkins; "Grain Size and Its Importance to Drop Forgers," H. W. McQuaid; "Stainless Steel," Earl Smith; "Economic Effect of Selling at or Below Normal Cost," C. R. Stevenson; "Report of Handbook Committee," L. W. Greve; "Business," Guy Emerson; "Experiences with Foremanship Training," A. R. Peirce.

Europe's Machinery and Tool Orders Go More and More to Germany

SPECIAL DISPATCH FROM OUR PARIS CORRESPONDENT

PARIS, France, Oct. 13—"The Triumphal Progress of German Machine Tools," a truly remarkable report, has caused considerable comment in connection with Monsieur Briand's plan for a United Economic Europe. The report, which shows the development of German trade in machinery and machine tools during the first six months of this year, was presented in connection with the formation of the preliminary committee. This committee contains 27 delegates appointed to find ways and means of steering Monsieur Briand's plan to realization. If his plan is realized, and European countries agree to trade with each other to any well-defined extent, it will unquestionably upset the balance of world trade.

In spite of strenuous international competition, according to the report, German exports of machinery and machine tools increased in the first six months of this year by 30 per cent in tonnage and 16 per cent in value. (For exports to France alone, the tonnage increase is closer to 200 per cent.) Obviously, considering the relation of price to tonnage, the cheaper lines are the ones gaining ground, but the proportions are significant none the less.

Of metal-working machinery and tools, the distribution was, in metric tons (2,204 lb.):

	First Six Months 1929	First Six Months 1930
France	38,346	105,477
Soviet Russia	37,999	71,813
Great Britain	35,227	56,382
Belgium	26,854	48,396
Italy	23,575	32,139
Czechoslovakia	24,021	31,052
Switzerland	22,639	24,410
Holland	23,915	22,367
Sweden	13,575	17,795
Argentine	16,671	18,403
Spain	13,495	11,435
Japan	15,127	4,160
Poland	16,191	4,122
Brazil	7,884	5,306

A second group is formed by woodworking tools with almost similar progress recorded. Stone-working machinery forms, however, but a small part of machinery exports, but hydraulic presses and other machinery have increased their figures, notably with exports to Soviet Russia, Great Britain, Switzerland, and Italy.

A consensus of recent German tool sales in France more than confirms the

opinion that so far as Europe is concerned, trade exchanges in these lines are fast approaching a point where the factor of competition affects German trade but little.

Detailed statistics issued by the League of Nations during the conference which was supposed to bring a tariff holiday into play, published in a recent issue of the *American Machinist* alone of all trade journals, proved this.

It is apparent that in many cases these exchanges show little change in values, but in almost every case an increase in volume. The inference is that prices are being lowered or that cheaper machines are being pushed at the expense of the higher grades. At all events, the proportionate cash return to German makers is inevitably none the less.

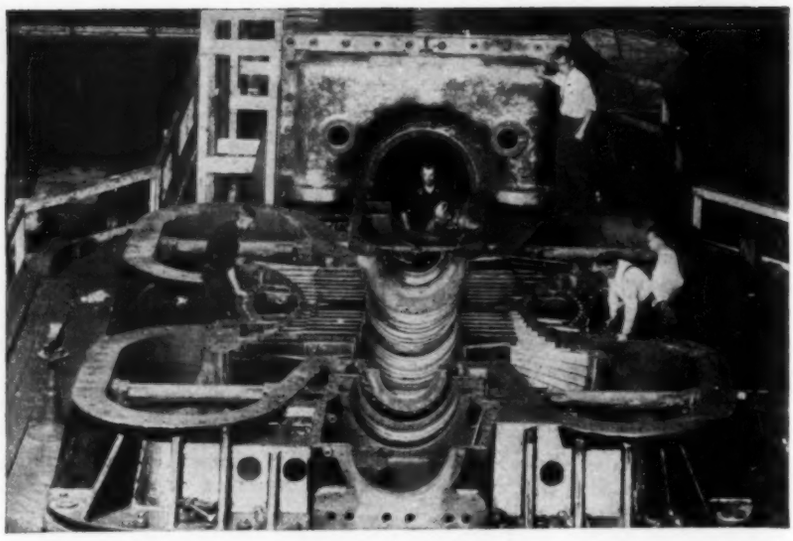
According to provisionary French customs figures, metal-working tools and machinery were imported from Germany during the first six months of 1930 to the extent of 4,110 metric tons, of a value of 34,316,000 francs. In 1929, the bulk was 3,621 tons and the valuation 35,500,000 francs.

French drilling, boring, and reaming tool imports from all sources are steadily increasing. During the first six months of the present year they doubled as compared with 1929, those from Germany forming a not inconsiderable part.

It has often been denied in many French trade circles that prices have perceptibly lowered, and it is probably true that they have not in many special cases where super-machinery is in question. It is true, however, that the demand is increasing for small shop equipment in the French provinces. This demand is for the more ordinary tools, not the new special equipment being installed in the higher qualified mechanical trades.

This is considered as accounting for an important part of the progressing German tool trade in France, above all for the heavier all-duty tools now coming across the border. It seems likely also that this phase of French trade is being stimulated by longer credits than those granted by distributors of American machine tools, or even by dealers in second-hand machinery. This latter is a considerably growing factor in the French trade, and one which, if not affecting imports of American tools of the more advanced type, is at least a consideration when the trade volume is tabled *in extenso*. It is here, at any rate, that Ge man procedure is making noticeable headway.

The American manufacturer has before now stated in the presence of most of us that he is a business man, not a banker, and that the matter of credits extended to the consumer of production machinery is one for the local distributor. The latter, on his part, replies that with the terms usually granted, it is likewise impossible for him to aid the credit situation, and that trade, as a consequence, often goes to the competing firm that will carry the credit load.



MORE POWER FOR FORD

Lower half of the low-pressure unit of the 110,000-kw., 1,200-lb. steam pressure vertical-compound turbine generator for the Ford Motor Co. plant at Dearborn, Mich. Workmen at the Schenectady Works of the General Electric Co. are here assembling the machine for factory tests

Laud Westinghouse At Shaft Unveiling

Industrial and financial leaders stood beside workmen on Oct. 6 in Pittsburgh and paid tribute to the genius of George Westinghouse, pioneer inventor and industrialist. The occasion was the unveiling of a memorial to Mr. Westinghouse in Schenley Park and marked also the 84th anniversary of the inventor's birth. President Hoover in his letter of regret that he could not be present said: "While it will be impossible for me to attend the exercises dedicating the memorial to George Westinghouse on Oct. 6, I wish your committee to know that I have a high appreciation of the outstanding accomplishments of Mr. Westinghouse during his notable career. . . . The inventions he created and the industrial institutions he established have been a most substantial contribution to our American life. . . . Characters such as he well deserve to be honored by their contemporaries and their successors. . . . You do well to commemorate his memory."

Pittsburgh district plants were closed so that workers might attend the ceremony, and Mayor Charles H. Kline of Pittsburgh proclaimed the day as "Westinghouse Day." James Francis Burke, who was introduced by E. M. Herr, vice-chairman of the Westinghouse Electric & Manufacturing Co., delivered the principal address.

Manufacturers Meet To Discuss Business

On Oct. 6 to 9, the National Association of Manufacturers held their 35th annual meeting in New York City. Pres. John E. Edgerton recounted the recent trend of business conditions and commented on the Association's part in business recovery. Reports of various committees were heard, and General Counsel James A. Emery reviewed important legislation. The Annual Trade Survey was preponderately favorable for increased activity this winter. Unemployment was the topic of the last day's meeting, company plans for employment security, and community activities toward alleviation being described. Dr. Royal Meeker characterized local efforts as palliatives and offered properly administered public insurance as the ultimate course.

Steel Founders Meet In New York on Oct. 22

The Steel Founders' Society of America, Inc., will meet at the Hotel Roosevelt, New York City, on Wednesday and Thursday, Oct. 22 and 23. W. H. Worrilow, Lebanon (Pa.) Steel Foundry, who is vice-president and chairman of the Eastern Division, S.F.S.A., will preside. Some of the speakers at the general session will be Arthur Marks, metallurgist and engineer, Clark McKercher, Harold S. Falk of the Falk Corporation, and Frank D. Glosser, Commercial Steel Casting Co. There will also be meetings of the Society's merchandising committee, technical research committee, and board of directors, and group meetings of producers of large and small steel castings. Many delegates will also attend the meeting of the American Iron & Steel Institute, which will be held the following day. Uniform cost accounting for alloy foundries will be discussed by H. S. Bartholomew, cost engineer, at the meeting on the 24th of the newly organized Heat-Corrosion Resistant Alloy Founders' Division, S.F.S.A.

Automotive Production Problems Discussed by S.A.E.

PAPERS presented at the Ninth Annual Production meeting of the S.A.E. in Detroit, Oct. 7 and 8, covered a wide range, including machining, tools, tool designing, the economic size of lot produced, conveyors, and wear of gages. Beyond these subjects, executives of automobile companies implored engineers to tell them how to guess probable sales so that they may iron out peaks and hollows in the production schedule.

R. L. Temlin of the Aluminum Company of America told of its struggles to educate users of aluminum to use the proper tools and showed the results of using too small rakes and clearances. While the term "aluminum" covers as many grades of metal as the term steel, he advised the use of 45-deg. top rake, a cutting angle of about 38-deg., 7-deg. clearance, and 15-deg. side rake for most cases, to give a smooth surface and high speeds. Taps to be backed out should have a hook or cutting angle on the back side, and spiral flutes help. Pure lard oil is the best coolant, but can be mixed with kerosene where insurance permits. Soluble oil mixed thicker than for steel can be used, but is not equal to pure lard oil. Tungsten-carbide tools work splendidly on aluminum.

The development of tungsten-carbide was described by W. H. McCoy, who has done much toward its successful introduction into the different divisions of the General Motors Corporation. He gave details of various cases in which tungsten carbide had saved from $31 to $1,450 per month on certain operations. He advocated using a good-sized tip, backed up by a heavy shank that would not only support the tip but help conduct the heat away, as localized heat tends to break the bond between the tip and the shank. Then too, it is essential to have the tool rigidly supported and to avoid lost motion in tool slides and feed screws. Heat-treating the tool shanks to remove strains before mounting tips helps tool life.

Increased top and side rake will tend to prevent the building up of metal on the edge of the tool. Just how much rake can be given depends on the strength of the material being cut, low-strength steels permitting the use of greater rake than normal. Tool grinding by the operator cannot be permitted with tungsten-carbide tools, and special care is needed in the selection of wheels. One of the discussors from the Oakland plant said that they had found an 80-R Carborundum wheel very satisfactory. Tools should be ground before they become very dull, from 5 to 8 thousandths being the usual grind in their plant. Mr. McCoy suggested the possibility of a larger number of grades of tungsten-carbide for different requirements, this not being favored by agents of some of the new metals. It was brought out that economy should be studied either from the angle of higher speeds, longer life, or both.

Ever since we began making more than one at a time of anything, men have argued as to the most economical size of lot to put through the shop. Paul N. Lehoczky of the Ohio State University presented a paper showing the effect of time on production costs. He gave a formula for determining the economical size of lot, considering the cost of tool set-ups, interest on investment, storage cost, and other items. From these he made a chart that saves calculation when the variables are known. As worked out this way, it is more economical to make the lot size sufficient for a three-months supply of product, increased cost of tool set-up being more than offset by lowered interest cost on investment in material. While the economical size of lot varies with product and other conditions, he points out very clearly that extremely long runs may not be economical.

Tool engineers play a large part in mass production, and O. B. Jones of the Detroit School of Applied Science pointed out where they fit in, and the qualifications necessary. The engineer who can fill all these requirements ought to be in direct line for general manager. In Mr. Jones' opinion, the day of the special machine is waning, this idea being promptly challenged in discussion, the differences being ironed out by rather vague definitions as to just what constitutes a special machine. The author made an excellent point regarding the need for ability to determine whether maximum economy lay in making a $100 or a $1,000 fixture, whether to use an extra second or two on the job or save the time by a heavier investment in the fixture.

Another excellent point was the necessity of securing the co-operation of the shop, from the superintendent down, in making fixtures perform. He advocated discussing fixture design with operators as well as foremen, and in giving way in minor points in order to get over the main idea. For when a man feels that he has had a hand in the design of a tool or fixture he does everything in his power to make it work.

"Conveyors in the Automotive Industry" was the title of a paper by J. H. Hough, in which he endeavored to sum up the principle types of conveyors suitable for automotive work. He also discussed the economies of conveyors, using the A.S.M.E. formula for determining when it was economical to install a conveyor and how much could be expended for it. The two examples given showed profits of 78 and 110 per cent on the investment, which seems to give the user the big end of the deal.

The question of floor space saved the reduction of material in process and the lessened fatigue of the men were discussed as was the sorting of parts on conveyors instead of in bins that take up valuable floor space. The use of ball and roller bearing conveyors save much in power and in easy handling, the wheel and axle conveyor having replaced the old "drag" type.

E. J. Bryant's paper on "Wear Allowances and Tolerances on Gages" was of great value to all production men. It contained many pointers on the reasons for gage wear, such as dirty work, handles large enough to enable the operator to force the gage in or on the work, the kind of materials gaged, and the like. Aluminum, brass, and cast iron are much harder on gages than soft steel. Uniform hardness is much more desirable than extreme hardness. File-soft gages wear longer on hard work than hard gages. A smooth, lapped surface wears best; high polish is not necessary.

Mr. Bryant gave an example of permissible gage wear, including the General Motors practice and others. He gave tables for gage makers' tolerances for plug and ring gages, for thread gages and for allowances and tolerances for metal fits. Periodical gage inspection was advocated and suggestions given for testing for wear, the effect of temperatures and other points. In a gage 32 in. long, for example, one deg. temperature difference means a change of 0.0002 in. in length.

Machine Tool Dealers Re-Elect Essley

At the regular fall meeting of the Associated Machine Tool Dealers, held this year on Oct. 6 and 7 at the Hotel Aspinwall, Lenox, Mass., E. P. Essley of Chicago was re-elected president, and A. G. Bryant, also of Chicago, was re-elected secretary-treasurer. J. W. Wright of St. Louis was elected a director and vice-president, and C. A. Odegaard of Chicago and C. E. Moore of San Francisco were elected directors. The meeting was well attended, a majority of the 45 member companies being represented.

E. P. Essley

BUSINESS ITEMS

The National Lock Washer Co., with plants in Newark, N. J. and Milwaukee, Wis., has recently completed its 4-story reinforced concrete addition to the Newark plant. The structure covers a gross area of 50,000 sq.ft., and is equipped for the production of car window equipment and marine speedometers, and the machining of drop forgings. Service units are set in the center of the glass-walled structure.

The Wrought Iron Co. of America has moved its New York offices from 393 Seventh Ave., to 40 Rector St.

The Klopp Engineering Co., has moved to its recently acquired industrial property at 17,185 Ryan Road, Detroit.

The St. John X-Ray Service Corporation, 505 Fifth Ave., New York, N. Y., has arranged with the Westinghouse X-Ray Co. Inc., to sell Westinghouse equipment in industrial fields.

A factory office has been opened by the Pacific Electric Manufacturing Corporation, 5814 Third St., San Francisco, at 89 Broad St., Boston, Mass. G. A. Wright is in charge.

T. Sakamoto, regular contributor to *American Machinist*, sends in this photograph from Kahuku, Oahu, Hawaii, with these words: "I enclose herewith a photograph of the shop men of our company, which we are willing to help any one at any time the best we can. From left to right: J. S. Verra, machinist helper, R. Suzuki, second lathe man, J. C. Sakamoto, chief machinist and shop foreman, K. K. Maruoka, drill press man, and T. Sakamoto, shaper and planer man"

The Domestic Electric Co., Kent, Ohio, acquired two years ago by the Black & Decker Manufacturing Co., Towson, Md., has changed its name as of Oct. 1 to the Black & Decker Electric Co.

The Worthington Pump & Machinery Corporation, 2 Park Ave., New York, N. Y., has acquired the Gilman Manufacturing Co., East Boston, Mass. No changes in personnel are planned.

The Bohn Aluminum & Brass Co., Detroit, will build a 40x300-ft. plant addition to cost about $45,000.

The Morel Foundry Corporation, 533 West Spokane St., Seattle, Wash., announces its merger with the Schilling Iron & Bronze Co., formerly at 1,200 Fourth Ave. South. Leon Morel is president.

The Utilities Equipment Corporation, Ltd., 110-120 North Alameda St., Los Angeles, Calif., has announced that the Jones-Lyman & Co., Inc., and the Utilities Equipment Corporation, Ltd., have consolidated and will operate under the name of Utilities Equipment Corporation, Ltd., exclusively.

The Orton Crane & Shovel Co., 608 South Dearborn St., Chicago, is planning an expansion program at its Huntington (Ind.) plant. A site has been purchased adjacent to the present one.

The structural and rail mill now under construction at the Weirton, W. Va., plant of the Weirton Steel Co., a unit of the National Steel Corporation, is nearing completion and will go into operation by Dec. 1.

The Buckeye Machine Co., an Ohio corporation, has been incorporated in Indiana to sell and erect engines and machinery and perform similar work. Field W. Sweezey, Indianapolis, is Indiana agent.

Anaconda American Brass, Ltd., New Toronto, Ont., is at present putting up a steel and brick extension to the new mill, approximately 450x75 ft., which is expected to be complete by Jan. 1. New machinery is being installed.

The Wilson Welder & Metals Co., Inc., has recently moved into its new all arc-welded building at 956-70 Thirty-Eighth St., North Bergen, N. J.

The Galt (Ont.) Malleable Iron Co., Ltd., whose plant was recently damaged by fire, is engaged in a reconstruction program. A one-story brick and steel building, 62x162 ft. is being erected, which will contain a pattern shop, carpenter shop, and department for light manufacturing. Provision will also be made for machining castings.

The R. L. Carter Co., New Britain, Conn., occupying a part of the Stanley Rule & Level Co. plant and formerly of Phoenix, N. Y., has incorporated with a capital of $50,000 under Connecticut laws. The company will continue to manufacture electrical woodworking tools as a subsidiary of the Stanley Works.

The Canadian Battery & Bohnalite Co., Ltd., is planning the manufacture in Windsor, Ont., of a number of hard surfaced Bohnalite products. A Dominion charter has been granted, and the work of installing machinery is to start at once. It is expected the plant will commence operations about Oct. 20, and be in full production by Nov. 1. The president is N. L. Olson, Detroit.

Noranda Mines will enter into the fabrication of its copper production through an alliance formed with the Canada Wire & Cable Co. The latter company will shortly commence the construction of a rod mill and wire-drawing plant adjacent to the copper refinery now being erected in Montreal by Canadian Copper Refineries, a subsidiary of Noranda Mines.

The Whitlock Metered Mail Co., Ltd., Los Angeles, has under construction a 2-story addition to the present factory on East Fourteenth St. W. J. Pearson is chairman of the board and J. Q. Finfrock is general manager. The plant addition now under way will be 50x165 ft.

Haberkorn & Wood, 2208 West Fort St., Detroit, Mich., have been appointed exclusive agents in the Detroit territory for the David Leckie Elevating Die Truck Co., Philadelphia.

The Brunner-Winkle Aircraft Corporation, Glendale, N. Y., has been reorganized and the name changed to the Bird Aircraft Corporation. T. G. Lanphier is president, W. E. Winkle, vice-president and general manager, and James Phelan, secretary and treasurer. The executive committee includes Mr. Lanphier, Mr. Winkle, F. W. Brooks, Jr., and Henry Breckenridge.

PERSONALS

Henry B. Allen, chief metallurgist of Henry Disston & Sons, Philadelphia, will speak on "Improvement in Steels for Wood Knives and Saws" at the meeting of the Wood Industries division of the A.S.M.E., at the Pennsylvania Hotel on Oct. 17.

Otto Becker has been appointed assistant superintendent of the Mystic Iron

Works, Everett, Mass., to succeed James H. Kennedy, resigned. Richard Stevens, assistant mechanical engineer, has been appointed master mechanic to succeed Frank J. Kennedy. Oscar R. Kroell has been appointed chief mechanical engineer, and John Drewson manager.

Stanley S. Boyer was elected president and general manager of the Herbrand Co., Fremont, Ohio, recently. Richard O. Mead was chosen vice-president.

Arthur S. Cummings has been appointed sales promotion and advertising manager of the American Monorail Co., Cleveland.

W. R. Cunnick has been appointed general manager of sales of the strip steel and strip steel sheet departments of the Weirton (W. Va.) Steel Co., with headquarters at Weirton. L. T. Lott has been made assistant general manager. A. C. Chilts succeeds Mr. Cunnick at Detroit.

Herbert E. Field, vice-president of the recently-formed Continental Roll & Foundry Co., Chicago, has resigned to become manager of roll sales for the Mesta Machine Co., Pittsburgh.

Bennie Isom, formerly of the Hutto Engineering Co., has been added to the staff of the Micromatic Hone Corporation, Detroit, Mich., as assistant to G. M. Calvert, head of the sales engineering staff. Mr. Isom will handle automotive accounts in the Detroit territory. G. J. Batzer will be in charge of the Cleveland territory, and O. W. Franke of the Eastern territory.

E. W. Kopke, formerly vice-president and manager of the Fulton Iron Works, St. Louis, has been elected president to succeed H. J. Steinbreder, who was chosen chairman of the board. Joseph W. Lewis was elected vice-president, and G. J. Kienzie was re-elected secretary and treasurer.

F. S. Macourek, for the past 13 years secretary-treasurer of the Vlchek Tool Co., Cleveland, retired Oct. 1. E. C. Koster, vice-president and factory manager, has been made executive vice-president, D. B. Wilson, secretary, H. F. Vlchek, treasurer, and J. C. Wattleworth, formerly assistant factory manager, was made factory manager.

W. G. McFadden has been appointed Detroit sales manager of the West Leechburg Steel Co., Pittsburgh, succeeding M. F. Lindley, who has been appointed general sales manager.

F. H. Maloney, St. Louis office manager for the Truscon Steel Co., has resigned to become affiliated with the Campbell Industrial Window Co., New York, N. Y.

B. F. Mercer, general superintendent of the Union Steel Casting Co., Pittsburgh, subsidiary of the Blaw-Knox Co., has been elected vice-president of Union Steel.

Ray H. Morris, district manager for the past three years for Brace-Mueller-Huntley Inc., Rochester, N. Y., resigned as of Oct. 1 to become affiliated with the sales staff of the Davenport Machine Tool Co. Inc., Rochester. His territory will include New York, southern New England, and northern New Jersey.

Elmer D. Moak has been appointed general manager of the Moak Machine & Tool Co., Port Huron, Mich., to succeed the late Eugene H. Moak.

Col. Frederick H. Payne, Assistant Secretary of War, will address the national convention of the American Hardware Association in Atlantic City, N. J., on Oct. 22, speaking on the subject, "What the War Department Is Seeking to Accomplish in the Industrial Phase of the National Defense Plan." The next day he will attend the New York meeting of the National Industrial Conference Board at the Hotel Astor.

William A. Reece has resigned as president and managing director of the General Electric, S. A., of Argentina, to become managing director of the Anglo-Argentine Electricidade. Charles C. Batchelder succeeds Mr. Reece, being appointed vice-president and general manager, and chairman of the executive committee.

Adolph A. Wagner, treasurer of the A. F. Wagner Architectural Iron Works, Milwaukee, has been elected vice-president and general manager to fill the vacancy caused by the resignation of W. F. Eichfeld.

Curtis C. Watts has been placed in charge of the division of the Black & Decker Manufacturing Co., Towson, Md., which has been established under the name of "Black & Decker-Van Dorn." This trade name will combine the products of the Van Dorn Electric Tool Co., and the Black & Decker organization. Mr. Watts' title will be assistant sales manager.

W. W. Weller has been appointed New England sales manager of the Adirondack Steel Foundries Corporation, Watervliet, N. Y., with district offices in Room 426, Park Square Bldg., Boston, Mass.

OBITUARIES

John Curry Chapman, factory manager of the Whitney Manufacturing Co., Hartford, Conn., died suddenly on Oct. 7 at Granby, Conn., while visiting with a friend. Mr. Chapman had been connected with the Whitney Manufacturing Co. for the past 12 years and had previously been associated with the Colt's Patent Fire Arms Co., and the Pratt & Whitney Co., both Hartford concerns.

Richard H. Edmunds, 73, founder and editor of the "Manufacturers' Record," died at his home in Baltimore, Md., on Oct. 4, following an illness of several months.

Thomas Watson Griggs, 55, vice-president of the Davenport (Iowa) Elevator Co., and the Davenport Machine & Foundry Co., died on Oct. 1.

J. Will Johnson, 61, vice-president of the Pyle-National Co., Chicago, died on Oct. 2 from injuries he sustained when struck by an automobile.

William A. Johnson, sales manager of the Pennsylvania Flexible Tubing Co., Philadelphia, died on Oct. 4 of heart disease while watching a football game.

William A. Porter, 70, secretary-treasurer of the Wetter Numbering Machine Co., Brooklyn, N. Y., died at his home in that city recently after a long illness.

John C. Reed, 83, formerly plant manager and general superintendent of the foundries of the Standard Sanitary Manufacturing Co., Pittsburgh, died on Oct. 1 at his home in that city.

James H. Reed, Jr., 46, president and a director of the American Die & Forge Co., Swissvale, Pa., died on Oct. 4 in New York City.

Frederick C. Thompson, 60, treasurer and manager of the Michigan Sprocket Chain Co., died recently after a short illness.

FORTHCOMING MEETINGS

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Calvin W. Rice, executive secretary, Engineering Societies Bldg., 29 West 39th St., New York, N. Y. The following meetings are scheduled:

Fifty-first annual meeting, Engineering Societies Bldg., Dec. 1-5.

Semi-Annual meeting, Birmingham, Ala., Apr. 20-23, 1931.

National Materials Handling Meeting and Management congress, Cleveland, Ohio, Apr., 1931.

National Aeronautic Meeting, Baltimore, Md., May, 1931.

STEEL FOUNDERS' SOCIETY OF AMERICA—October meeting at Pennsylvania Hotel, New York City, on Oct. 23, the day preceding the New York meeting of the American Iron & Steel Institute. G. P. Rogers, 932 Graybar Bldg., New York City, is managing director.

AMERICAN IRON & STEEL INSTITUTE—Semi-annual meeting, Hotel Commodore, New York, N. Y., Oct. 24. E. A. S. Clarke, secretary, 75 West St., New York, N. Y.

NINTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING—In Grand Central Palace, New York City, Dec. 1-6. Charles F. Roth, manager, Grand Central Palace.

WESTERN METAL CONGRESS AND EXPOSITION—Second National, Civic Auditorium, San Francisco, Calif., Feb. 16-20, 1931. Under auspices of A.S.S.T. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine-tool business

NEW ENGLAND

September sales information available on machine tools in the New England territory indicates totals below expectations. Gains were small. Companies that showed substantial increases in August over July didn't do so well in September. Some companies made highly satisfactory gains, but as near as can be ascertained these were in the minority.

October weeks to date have been a repetition of the last weeks in September. Domestic buyers are holding back on requirements. Small automatics are selling better in the radio and small parts field.

Industrial conditions in general lines show sufficient activity to maintain increased schedules of recent weeks. Bearings companies are more active. During the week Fafnir interests booked large orders for the new Fafnir-Melcher bearings for delivery to the St. Louis Car Co.

INDIANAPOLIS

Little change is seen in the general demand for machinery and machine tools here. Some buying is being done, but demand does not have the healthful tone it should have. Material being bought does not represent much expansion, being mostly for replacement.

There is a lack of demand from the automobile industry. Demand from the iron and steel industry seems to be picking up a little. Several factories have increased production and some even have announced some expansion projects.

Some demand comes from the coal trade for special machinery and for small tools for machine shops at the mines. Machinery manufacturers report some export business. Dealers in used machinery say that while there are some inquiries, prospective buyers seem to want to use songs instead of money.

CINCINNATI

A few of the machine-tool manufacturers of the Cincinnati district reported business a shade better last week. The remainder find at least some comfort in the fact that there was no downward trend.

Selling agents report that while requests for quotations are coming from machine-tool users of all kinds in local and adjacent territory, few purchases are being made.

While here and there was an order that called for two or three items, the greater portion of the week's business was made up of the sale of single tools and replacements. The sales were well scattered geographically and the needs were well diversified, the principal buyers being general machinists and miscellaneous users.

SOUTHERN DISTRICT

Machinery and machine-tool business of this district showed slight improvement over the previous fortnight. Sales continued to be made up from scattered industries and were accounted for by inquiries from a widely spread territory. The chief centers of activity—New Orleans, Birmingham, and Houston, showed little material change, save that the Southwest appeared to be buying a little heavier than previously reported. The Southeast area continues in a slump with business along the lower section extremely dull.

Small tool sales were responsible for the bulk of business, and some movement of used tools and equipment was in evidence. Orders for the most part are being filled promptly, and deliveries are well up to schedule. Prices have neither softened nor advanced, and this appears as true of the used machinery and machine-tool market as of manufacturers' prices. Hope is held out that October will show a decided improvement in market conditions.

■

SPOTTINESS recurred in machinery and machine-tool markets of the country last week. Continuing pessimistic pressure, last week's stock market drop, and the year-end exhaustion of foreshortened budgets, all are combining to make such orders as are being obtained prizes for consistent and persistent pounding. New England's expectations were not fulfilled in September, and October so far is unchanged. There were some reports of upturn, though domestic buyers are holding back. Indianapolis buying is for replacement, with demand from the iron and steel industry, coal trade, and for export counterbalancing the automobile industry's lack of interest.

CINCINNATI manufacturers are coming up in some cases, holding steady in others, while sales agents are busy on inquiries but have no orders. Southern District business is picking up, particularly in the Southwest, agreeing with other sections in that most sales are for small tools. Some used tools are being sold throughout the country, although purchasers are inclined to offer, as Indianapolis puts it, "songs instead of money." Seattle sellers are reflecting the slow condition of the lumber business there.

MILWAUKEE manufacturers, using business psychology, have succeeded in wheedling, cajoling, arguing, or threatening orders out of a wide variety of prospects, some orders being for as many as a half dozen tools. The outlook there and that in Canada are both promising, a variety of industries being interested. New York still suffers from the proximity of Wall Street.

SEATTLE

Conditions among the machinery and machine-tool houses of the Pacific Northwest are spotty. Plants and agencies depending on construction activity have had a fair year. Those whose business comes from the lumber and logging industries are suffering almost as acute depression as are the manufacturers of forest products.

Manufacturers of Diesel-powered logging machinery are figuring on increased demand. Plants specializing in marine work are inactive, a seasonal condition. Prospects of increased marine Diesel installation during the fall and winter give promise of additional business. Machine shops and machine-tool distributors have had a slow year, largely due to lack of buying and repair work by lumber plants. Some houses look for improvement during the fall, but no marked upturn is expected until next spring.

Houses distributing compressors, concrete mixers and equipment, power shovels, and similar machinery had a large turnover prior to July 1. The last few months have witnessed considerable slowing down as building construction decreased. Improved demand is expected during the next two months and the year's record will probably be on a par with 1929.

MILWAUKEE

Manufacturers of machinery and machine-tools are actually getting results from sales efforts. Not only are prospects encouraging, but hard work has resulted in closing orders from a wide range of industries. Business in August proved disappointing, but September figures show a sizeable increase, while the first week in October showed further marked improvement. If business continues to increase during the remainder of this month as it did the first part, October will show a healthy volume. Several manufacturers are firm in their opinion that business has finally opened up and will continue to go up from now on.

While a good part of orders placed are for single tools used for replacements, several orders have been placed here for a half dozen or more units each. These have come from small tool manufacturers who have been buying cutters, reamers, and similar equipment. The automotive trade has also been in the market, although not on a large scale. Railroads are still making inquiries and are placing orders for an individual unit or two. Agricultural implement manufacturers are quiet. The steel and mining industries and electric equipment manufacturers have shown increased activity.

CANADA

The machinery and machine-tool market in Canada shows signs of "snapping out" of the more or less lethargic state in which it has been during recent months. Betterment is seen all along the line and the outlook is decidedly promising. Sales of general machinery have increased. Commencement of work on the $50,000,000 railway terminal scheme in Montreal is expected to promote sales of road and construction machinery. Railway purchases of rolling stock and equipment are still being held to immediate requirements, but iron and steel manufacturers are encouraged by the announcement that the railways will be in the market before the end of the year for a large volume of material for branch line construction. Automotive production is more active now than during the first half of September. Accessories and replacement parts are moving well. Conditions in the electrical equipment market show an improvement.

NEW YORK

The dealers' convention took many New York dealers out of the city for several days last week, and one downtown street affected those who remained in town. As one aptly put it, "We ought to drop Wall Street in the Hudson, and put a damned big weight on top." General inquiries, usually for single items, were more in evidence, but few sales were consummated. The situation is considered hopeful, even though the real buying upturn is not expected until 1931 budgets are released. One large dealer had September sales 20 per cent above those of August, and found to his surprise that this summer's sales are far better than those of 1920-21. Other dealers might be similarly surprised on a check-up. Soviet Russia's purchases in the fiscal year ended Sept. 30 were $145,000,000, exceeding by 35 per cent the figures of last year.

BUSINESS • BAROMETER

Optimists seem to have the best of the argument unless unforeseen circumstances alter conditions

THEODORE H. PRICE
Editor, Commerce and Finance, New York

THE spirit of revolution and political unrest that has recently been manifest in South America and Cuba had a disturbing effect upon last week's markets. In the United States these Latin-American upheavals have not hitherto caused much anxiety, but no previous revolution has been the equal of the present movement in the number of countries that it includes.

It is hoped and believed that our friends in the South American countries affected will be able to re-establish stable government. Little blood has as yet been shed, and a bloodless revolution is sometimes an effective measure of reform.

In Cuba the situation is almost entirely due to the distress caused by the decline in sugar. If a way to improve the value of sugar could be found the Cuban depression would speedily disappear. Therefore, it is hoped that the Committee which is trying to get the sugar producers of the world to restrict their production or their exports will be successful. It has announced a definite plan for withholding 1,500,000 tons of Cuba's from the market which will probably be made effective. It is, however, too early to say whether the assent of Java and the European producers can be obtained to anything like an agreement to restrict production.

Meanwhile, the advance in futures is an expression of hope refreshed as well as belief that the pressure from Cuba will soon be greatly lightened.

Most of the news that comes from South America is censored. For this reason it is difficult to get at the facts, but confidential advices by mail and wireless indicate that the revolutionary governments thus far established are fairly secure and popular with the people. It is doubtful, therefore, whether our trade with these South American countries will be much affected.

In Brazil the price of coffee is the main issue, and all the political aspirants are promising to put coffee up when they get in office. It is, however, doubtful, whether any Brazilian government can be more successful than the present one, which has sponsored a variety of schemes to support the market. But the supply of Brazilian coffee, including the current crop, equals nearly three years' world consumption, and some reduction must be effected before there can be anything more than a superficial improvement.

Silk, rubber, cocoa, copper, and tin all have touched new low prices within the past week or two, but most of them have recovered to varying degrees.

The American stock market has been weak. Aside from the effects of two brokerage house failures, its weakness was so plainly the result of short selling and bear propaganda that the New York Stock Exchange has felt impelled to take action. It is understood to have notified some of its members that further short selling would be frowned upon and disciplined. The result has been to restrict operations for the decline, and to attract some of the investment buying which always makes itself felt when a well-advertised decline in stocks occurs.

Between the pessimists and the optimists there is a distinct difference of opinion about business. The pessimists insist that conditions are no better than they have been, and that any appearance of improvement is an illusion created by the Pollyanna's who put a favorable interpretation upon everything. The optimists point to the fact that distributive trade is off only in dollars, and that, allowing for lower prices, the volume must be fully as large as last year; and assert that confidence is reviving among those whose business is constructive, favored by the continued cheapness of money.

There is, of course, room for disagreement, but the optimists seem to have the best of the argument at present, and the indications appear to justify the predictions of reasonable trade activity for the balance of the year. From now on, comparisons with 1929 will be against much lower figures. The declines shown will, therefore, be smaller, and though the fact is not intrinsically important the appearance of smaller figures after the minus signs is likely to help confidence measurably.

The automobile manufacturers are reconciled to a dull fourth quarter, but some think it will be better than 1929. The steel industry is going along hopefully at a moderate pace. At ten cents a pound, a pronounced improvement in the demand for copper is also noticeable, and the whole commercial and industrial world reflects the gain in confidence that has made itself felt since the commodity markets became steadier. This is not to say that the world's essential staples will advance immediately, but cheap money plus raw material at a reasonable cost are important factors in the omposition of prosperity, and their influence must be felt unless it is offset by some intensely discouraging condition of which there is no present indication.

THE BUSINESS WEEK

October 15, 1930

THE beginning of the fourth quarter shows no quickening in the business tempo other than a moderate expansion of retail trade under the usual stimulus of seasonal influences and low prices. Such expansion is characteristic of poor as well as good years, and gives no special indication that real recovery this year is under way. On that point the stock market has given its verdict decisively, and should soon begin to utter its oracle as to what the gods of the Cycle—before whom American business intelligence now prostrates itself—have decided for next year. As the slight decline in our index, from 86.4% to 86.3% of normal shows, industrial activity lags behind even seasonal expectations; but this disappointment is tempered by the knowledge that the volume of consumption is still fairly well maintained and that shelves are gradually being cleared. A belated seasonal expansion in commercial borrowing and currency circulation, together with a relative improvement in residential building are brighter spots in the general gloom. But the widening circle of political unrest abroad; the continued draft upon the gold reserves of distressed countries by America and France, unwilling or unable to use it; the collapse of the foreign bond market here—all are clouds on the winter horizon, testifying to the failure of financial and business leadership in this country during the past summer.

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THE WEEKLY PRICE GUIDE . . . .

Rise and Fall of the Market

PRODUCTION of pig iron is down to lowest levels reached in the last six years. There is active inquiry for steel to be used in railway and subway maintenance and construction; otherwise, the market continues dull. This week, as in the week preceding, there were no advances in prices of materials listed here. Declines continue to constitute the rule, with reductions current in copper, tin, zinc, lead, fabricated brass and copper, solder, babbitt metal, roll sulphur, linseed oil and rubber belting.

(All prices as of Oct. 10, 1930)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$16.69@$18.19
Northern Basic	19.89@ 20.39
Southern Ohio No. 2	19.89@ 20.39
NEW YORK—Tidewater Delivery	
No. 2 Southern (silicon 1.75@2.25)	18.00@ 18.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	14.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	20.00
Virginia No. 2	18.75@ 19.25
Basic	22.29
CHICAGO	
No. 2 Foundry, local (silicon 1.75@2.25)	19.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	18.20
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	19.63@ 20.13
Basic	19.63@ 20.13
Bessemer	20.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00
Cleveland	4.75
Cincinnati	4.45
New York	4 75@5.00
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed*	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	1.90@2.00	3.35†	3.00	3.40†
No. 12	1.95@2.05	3.45†	3.10	3.45†
No. 14	2.05@2.15	3.55†	3.20	3.50†
No. 16	2.15@2.25	3.65†	3.30	3.60†
Black				
Nos. 18 to 20	2.25	3.60†	3.40	3.70
No. 22	2.40	3.75†	3.55	3.85
No. 24	2.45	3.80†	3.60	3.90
No. 26	2.55	3.90†	3.70	4.00
No. 28	2.70	4.05†	3.85	4.15
Galvanized				
No. 10	2.30@2.40	3.65†	3.65	3.55
Nos. 12 to 14	2.40@2.50	3.75†	3.75	3.65
No. 16	2.50@2.60	3.85†	3.85	3.75
No. 18	2.65@2.75	4.00†	4.00	3.90
No. 20	2.80@2.90	4.15†	4.15	4.05
No. 22	2.85@2.95	4.20†	4.20	4.10
No. 24	3.00@3.10	4.35†	4.35	4.25
No. 26	3.25@3.35	4.60†	4.60	4.50
No. 28	3.50@3.60	4.85†	4.85	4.75

*Light Plates. †400 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. butt	56.14%	43.6%	53.3%	42.3%	57.3%	44.8%
3½ to 6 in. lap	52.72%	40.18%	50.8%	37.8%	53.9%	41.4%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28
8	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness—Decimal	Thickness—B.w.g. and Fractions	Outside Diameter in Inches—Price per Foot: ½	⅝	¾	⅞	1	1¼	1½
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	7.00	6.00	6.15
Hoop steel	3.75†	4.00	3.75†
Cold rolled strip steel	4.95	6.00	6.10
Floor plates	4.85†	5.30	5.00†
Cold fin., round or hexagon‡	3.40	3.65	3.35
Cold fin,, flat or square‡	3.90	4.15	3.85
Structural shapes	3.10†	3.00	3.00†
Soft steel bars	3.10†	3.00	3.00†
Soft steel bar shapes	3.10†	3.00	3.00†
Soft steel bands	3.40†	3.65	3.20†
Tank plates	3.10†	3.00	3.00†
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, 3/16-in. thick by ¾-in. wide. †400 to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse—3/32, 8.35c. per lb.; ⅛, 7.85c. per lb.; 5/32 to ½, 7.35c. per lb.

METALS

Warehouse Delivery Prices in Cents Per Lb. for Small Lots:

Copper, electrolytic, New York			11.50
Tin, Straits, pigs, New York			31.50@32.50
Lead, pigs, E. St. Louis	5.05	New York	6.00@ 7.00
Zinc, slabs, E. St. Louis	4.20	New York	6.00@ 7.00

	New York	Cleveland	Chicago
Antimony, slabs	10.00@10.50	11.00	10.75
Copper sheets*	20.25	19.75	20.50
Copper wire*	11.75	12.87½	13.12½
Copper, drawn, round*	18.75	18.25	19.00
Copper tubing*	22.50	22.00	22.75
Brass sheets, high*	17.37½	17.00	17.62½
Brass tubing, high*	22.25	21.87½	22.50
Brass rods, high*	15.62½	15.25	15.87½
Brass wire, high*	17.50	17.50	18.12½

*Mill, base.

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%†	24.25	24.30	23.30
Zinc sheets (casks)	9.75@10.25	11.25	10.11
Solder (½ and ½)	23.50	23.50	22@24

Babbitt metal, delivered in case lots, New York, cents per lb.:

Genuine, highest grade	48.00
Commercial genuine, intermediate grade	35.00
Anti-friction metal, general service	30.00
No. 4 babbitt, f.o.b.	10.25

†F.O.B.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va.:

	Nickel	Monel Metal
Sheets, full finished	52.00	42.00
Sheets, cold rolled	60.00	50.00
Strip, cold rolled	55.00	45.00
Rods, hot rolled	45.00	35.00
Rods, cold drawn	50.00	40.00
Tubing	75.00*	90.00†
Angles, hot rolled	50.00	40.00
Plates	52.00	42.00

*Seamless. †Welded.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars:

	New York	Cleveland	Chicago
Crucible copper	8.25 @8.50	8.75	8.00@ 8.50
Copper, heavy, and wire	8.00 @8.25	8 25	7.50@ 8.00
Copper, light, and bottoms	7.00 @7.50	7.25	6.75@ 7.25
Heavy lead	4.25 @4.37½	4.00	3.25@ 3.75
Tea lead	2.00 @2.25	2.50	2.25@ 2.75
Brass, heavy, yellow	5.00 @5.25	4.75	4.50@ 5.00
Brass, heavy, red	7.25 @7.50	8.00	6.75@ 7.25
Brass, light	4.00 @4.25	3.75	4.00@ 4.50
No. 1 rod-brass turnings	5.25 @5.50	5.25	4.50@ 5.00
Zinc	2.00 @2.25	1.50	1.50@ 1.75

TIN PLATES—Charcoal—Bright—Per box:

"AAA" Grade:	New York	Cleveland	Chicago
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13	$0.16	$0.15
Cotton waste, colored, per lb.	.09½	.12	.10
Wiping cloths, washed, white, per lb.	.14	38.00 per M	.14½
Sal soda, per lb.	.01½	.02	.02
Roll sulphur, per lb.	.028	.03	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.	.106	.125	.108
Cutting oil, about 25% lard, in 5 gal. cans, per gal.	.65	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.	.33	.36	.24
Belting—Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin.ft., per inch of width, for single ply:			
Medium grade	30–10%	30–10%	35%
Med. grade, heavy wgt.	30%	30 –5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	60%	50–10%	50%
Second grade	60–5%	60– 5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.031	$0.031	$0.0325
Cold fin. shafting	per lb.	.034	.034	.036
Brass rods	per lb.	.1562½	.1612½	.2125
Solder (½ and ½)	per lb.	.235	.245	.32
Cotton waste, white	per lb.	.13	.13	.13
Disks, aluminum oxide mineral, cloth, No. 1 6-in. dia.	per 100	4.59	4.59	3.60
Lard cutting oil	per gal.	.65	.65	.75
Machine oil	per gal.	.33	.33	.33
Belting, leather, medium	off list	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs	off list	65%*	65%*	50–10%*

*List prices as of April 1, 1927

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*	$6.03	$6.03	$6.03
Emery cloth*	25.87	25.87	25.87
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†	2.61	2.61	2.61
Cloth†	4.59	4.59	4.59
Fire clay, per 100 lb. bag	1.00	.75	75
Coke, prompt furnace, per net ton	Connellsville,		2 60
Coke, prompt foundry, per net ton	Connellsville,		3.50@4.85
White lead, dry	100 lb. kegs	New York,	13.75
White lead, in oil	100 lb. kegs	New York,	13.75
Red lead, dry	100 lb. kegs	New York,	13.75
Red lead, in oil	100 lb. kegs	New York,	15.25

*Less than 3 reams. †Less than 200.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less	65%
Larger, up to 1 x 30-in., full kegs, list less	65%
Less than full kegs or case lots, add to list	10%
Fitting-up bolts: list less	45%
Lag screws:	
Up to ½-in. x 6-in., list less	65%
Larger, list less	65%
Less than full keg or case lots, add to list	10%
Rivets:	
Structural, round head, full kegs, net	$4.50
Structural, round head, broken kegs, net	6.00
Tank, 7/16-in. dia. and smaller, list less	65%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less	65%
Larger, up to 3-in., list less	65%
Less than keg or case lots, add to list	10%
Washers:	
Wrought, full kegs, per 100 lb., list less	$4.00
Wrought, broken kegs, per 100 lb., list less	2.00
Turnbuckles:	
With stub ends, list less	20–10%
Without stub ends, list less	55%
Chain:	
Proof coil, base, per 100 lb., net	$8.50
Cast iron welding flux, per lb., net	.35
Bronzing flux, per lb., net	.50

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

Ariz., Phoenix—J. B. Brown, Supt., U. S. Indian School—will receive bids until Oct. 21 for a hollow arm post sander, arms to be approximately 4 ft. 8 in. long, sand disc about 8 in., equipped with special exhaust fan, vertical motor coupled to countershaft and stand motor base and pulley for belt drive, electric power, 220 v., 3 ph., a.c., 60 cycle.

Opportunities for Future Business

Calif., Los Angeles—Baker Oil Tools, Inc., 2959 East Slauson St., Huntington Park, awarded contract for a 1 story, 65 x 577 ft. factory. Estimated cost $125,000.

Calif., San Francisco — Truscon Steel Co., Call Bldg., is receiving bids for the construction of a 1 story warehouse and shops at Carroll and Newhall Aves. Estimated cost $50,000. Overhead crane will be installed.

Conn., New Haven—Connecticut Bearings Co. Inc., F. C. Bradley, 294 York St., is receiving bids for the construction of a 1 story machine shop and garage at 59 Goffe St. Estimated cost $40,000. Private plans.

D. C., Washington — Bureau of Yards & Docks, Navy Dept., received lowest bid for improvements to brass foundry from Fanning & Sweeney Inc., Greensboro, N. C. $37,000. Noted Aug. 28.

Ill., Chicago—Ideal School Supply Co., 8316 Birkshoff Ave., awarded contract for a 1 story, 60 x 120 ft. woodworking plant. Estimated cost $50,000.

Ill., Chicago — Olive Can Co., 450 North Leavitt St., plans addition to plant. Estimated cost $50,000. Storbel & Hall, 190 North Clark St., Archts. and Bldrs.

Ia., Des Moines—F. M. Hubbell Co., Hubbell Bldg., received lowest bid for the construction of a garage at 218 4th St. from Garmer & Stiles, 519 14th St. $30,000. F. T. Bristol, c/o owner, Archt.

Ia., Sioux City—John Deere Co., Moline, Ill., manufacturers of farm implements, awarded contract for the construction of a 3 story, 69 x 186 and 1 story 60 x 80 ft. warehouse and office at Jones St and Missouri River Rd. Estimated cost $96,000.

Kan., Kansas City—Wilson & Co., c/o C. A. Dunseth, Treas., awarded contract for the construction of a 1 story, 75 x 195 ft. garage at Osage and Adams Sts.

Mass., Bourne—R. Bigelow, Monument Beach, plans the construction of a 1 story, 60 x 200 ft. boat building plant near Canal. Estimated cost $40,000 to $50,000. Private plans.

Mass., Dorchester (Boston P. O.)—Knox & Morse Co., 70 Freeport St., plans to rebuild machine shop and storage building recently destroyed by fire. Estimated cost $15,000 to $25,000. Architect not selected. F. O. Gould, manufacturer of screw machine products, lessee.

Mass., Pittsfield—General Electric Co., E. A. Wagner, Gen. Mgr., is having plans prepared for the construction of a 1 story, 150 x 600 and 30 x 350 ft. transformer tank plant at Tyler St. and Benedict Rd. Estimated cost $1,000,000. Private plans.

N. J., Jersey City—J. Goldenberg, 80 Woodland St., Englewood, is having revised plans prepared for a 4 story, 90 x 150 ft. garage, etc., at Sip and Summit Aves., here. Estimated cost $250,000. C. Shilowitz, 26 Journal Sq., Jersey City, Archt.

N. J. Montclair—White Motor Sales Corp., 640 Bloomfield Ave., will not construct service garage at Grove St. and Glenridge Ave. $40,000. Project in abeyance.

N. J., Newark — Schwartz Bros. Truckmen, Inc., 263 Lafayette St., is receiving bids for a 1 story, 100 x 150 ft. garage on Roe St. Estimated cost $150,000. Private plans.

N. J., Somerville—Bd. of Education, Somerset County, plans the construction of a vocational school. Estimated cost $150,000. Maturity in spring or summer, 1931.

N. Y., Long Island City—Brien Holding Corp., 247 Lanford Ave., Flushing, plans the construction of a 2 story, 125 x 192 ft. service garage and storage building at 40th Rd. and Main St. Estimated cost to exceed $40,000. W. Hohauser, 17 West 44th St., New York, Archt.

N. Y., Long Island City—Rhodes & Schamfeld, 31-88 33d St., will not construct garage, service station, etc., at Broadway and 23rd St. $40,000. Project in abeyance. Noted May 8.

N. Y., Syracuse — Syracuse Lighting Co., South Warren St., plans extensions and improvements to plant, including service and storage building, garage and repair shop, etc. Bids are now being taken for an auxiliary garage. Estimated total cost $3,000,000. Melvin King, East Fayette St., Archt.

N. C., Durham—Durham Public Service Co., plans the construction of a 1 story, 100 x 182 ft. garage. Rose & Rose, Trust Bldg., Archts.

O., Warren—Federal Machine & Welding Co., is having plans prepared for the construction of an 80 x 200 ft. plant. Estimated cost $250,000.

Pa., Erie—Bender Marine Sales Co., G. F. Bender, 9th and Peach Sts., awarded contract for a 1 story, 118 x 170 ft. marine sales, service and storage building on State St. Estimated cost $50,000. Noted Sept. 25.

Pa., Washington—Bd. of Education, R. C. Buchanan, Pres., 925 Washington Trust Bldg., awarded contract for the construction of a junior and senior high school, including 52 x 350 ft. main building, 72 x 125 ft. shop building, etc., at Jefferson and West Hallem Aves. and Allison St. Estimated cost $650,000. Noted Oct. 2..

Va., Clifton Forge—Chesapeake & Ohio Ry. Co., Richmond, will soon award contract for improvements to locomotive shop here. Estimated cost $153,460. C. W. Johns, Richmond, Ch. Engr.

Wis., Milwaukee — **Filer & Stowell**, 219 Becher St. (iron works), awarded contract for the construction of a 3 story, 70 x 81 ft. factory.

Ont., Copper Cliff—International Nickel Co. of Canada, Ltd., awarded contract for structural steel in connection with new plant for housing No. 1 refinery unit, which is to be transferred from Port Colborne to Copper Cliff. $500,000.

Ont., Toronto—Canadian Pacific Ry., H. O. Windsor Station, Montreal, Que., awarded contract for a group of buildings, including storehouse, round house, repair shop, yard office, etc., at Fleet and John Sts. here. Estimated cost $500,000. J. M. R. Fairbairn, Montreal, Ch. Engr. Noted Sept. 11.

Quebec — American Brake Shoe & Foundry Co., 230 Park Ave., New York, N. Y., plans the construction of a steel mill, foundry, etc., here.

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The Agent—
The Seller—
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